Fix It Yourself

Home Repairs Made Easy

HANDYMAN'S MODERN MANUALS

FIX IT YOURSELF

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Home Repairs Made Easy

A COMPLETELY INDEXED MANUAL
FOR HOME OWNERS AND HANDY MEN

Woodworking · Painting · Plumbing
Electrical Appliances
Concrete and Metal Work

Prepared by the EDITORIAL STAFF
of POPULAR SCIENCE MONTHLY

With 165 Illustrations and Diagrams

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PREFACE

IN THIS age of mechanical marvels all of us must be, to some extent, mechanics ourselves. Indeed, without a certain handiness and knowledge of repair work, we cannot keep our houses shipshape, comfortable, and attractive. Even such minor difficulties as a balky window or a squeaking stair tread can be most annoying unless we know how to remedy them.

After all, the least important defects which develop in all houses—and the ones most easily corrected by the home owner himself—are the very ones that are the most aggravating.

For the large and important jobs we do not hesitate to call in a carpenter, plumber, mason, electrician, painter, or tinsmith. The work is done with a reasonable degree of promptness; and, usually with some inward grumbling, we foot the bills. In the case of small repairs, however, we often neglect to summon a professional mechanic. We know that he will have to charge for his time in coming and going and for his overhead and other expenses and that the bill is therefore very likely to be one that will shock us by its size, even when we realize the reasonableness of it from the mechanic's standpoint. Besides, we know that mechanics often dislike to undertake small jobs, principally because it interferes with their regular schedule of work and partly, perhaps, for the very reason that they know the necessary charges will be regarded as high, if not unreasonable.

My own plumber makes a charge of three dollars for repairing a leaking faucet, so he tells me. I have never had him fix one for me, although recently he did collect sixteen dollars for stopping a small leak under a stationary washtub, which involved replacing the strainer and considerable lead pipe. The latter was properly a job for a plumber, but replacing worn washers in faucets is something that the home owner can do himself so easily and quickly that it is almost absurd to ask a plumber to waste his time with it.

For years I have been telling how to do repair jobs. Friends have asked repeatedly for a book giving the same information in a readily accessible form. They have asked for something like one of the various baby books to which a mother can turn for help on practically any ordinary problem. The outgrowth of those requests is this book.

THE EDITOR

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CHAPTER I

REPAIRING THE OUTSIDE OF YOUR HOUSE

AS THIS chapter describes the making of repairs to the exterior of buildings, including the roofs, it is well to note that all materials used should be weather resisting. The first and most important questions to be asked are: whether the kind of wood to be used will withstand rain alternating with the heat of the sun; whether it will resist the frosts of winter; and whether it will hold up under conditions of continuous moisture, even if painted, or will it warp, crack, or rot?

Long experience teaches that certain woods alone are fitted for outside exposure. What will make excellent material for interior work may not serve at all for exterior. It is best to follow accepted usage in this. The varying climate and the kinds of lumber locally available are factors, and your choice must be guided by the usage of your own section of the country.

One example of the wrong choice of wood was noted years ago in Albany, N. Y. Here, in a fine mansion built after the style of "The House of the Seven Gables," the main beams of each gable, 8 by 8 in. or larger and entirely exposed to the weather, were built of unsuitable wood. Within five years scaffolds had to be built up to each one and the rotted parts replaced with sound white pine. It was a costly error, but one repeated in a lower degree all over the country.

One may see, for example, a porch floor that is sound and good as new after twenty years or more, yet another floor may have to be replaced in five years or even less. Be careful, therefore, to choose the materials that by common consent are held to be suitable for outside work.

Do not use sappy wood under any circumstances. If moisture can get at it, such wood will rot in a very short time and is, therefore, pure waste. Sound knots are not to be rejected, but be sure they are sound; that is, they should form an integral part of the board, with no chance of ever breaking away and

dropping out. In some woods there are many black knots that are likely to drop out as the board weathers.

Of the various kinds of woods suitable for the repair of exterior woodwork, some are more readily obtainable, and therefore in more general use in one locality than another. For example, in the eastern part of the United States sound-knot white pine and cypress are favored. Your lumber dealer will be able to tell you which is the most suitable and economical wood to buy in your own particular district.

How to Repair Cellar and Basement Windows

Often the sill and the bottom rail of the sash in cellar frames are rotted or splintered, or have been

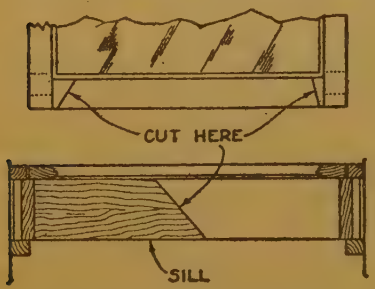


Fig. 1. How to cut away the decayed sill of a cellar window frame and the lower rail of a sash.

broken by the coal chute. First remove the sash by taking out the hinge screws. Frequently the screws are so rusty that they cannot be removed; in that case pry them off with a pry bar or similar tool, and plug the screw holes for new screws.

Take a coarse saw and cut straight across the sill at an angle, and with a heavy chisel split it so that the parts may be removed readily. Break off the protruding nails and fit in a new sill as tightly as possible. To secure it, drive nails at an angle (slantwise) from the sides (Fig. 1).

To remove the bottom rail of the sash, make a cut at both ends close to the sidepieces, called stiles. Tap gently, and the piece so cut will drop away from the glass. With care, the short pieces, including the tenons, may be removed without breaking the glass.

A new rail may be placed in two ways. In the first and more difficult, it can be made with tenons like the old rail and tapped up into place from the bottom of the sidepieces, after the small section below each of the old mortises has been removed. In the second method, the rail is fitted between the sidepieces without tenons, the old side mortises being plugged. It is simply nailed in place, and small flat-shaped mending plates are added on the inside, at each corner.

In a cellar sash it is not necessary to match the molded edge of the sash; a simple bevel will do. The rabbet for the glass may be cut with a rabbet plane or with a back saw and chisel.

When Porch Steps Become Loose or Decay

If any of the steps—treads as they are called—are loose and a nail will not hold, it indicates that the

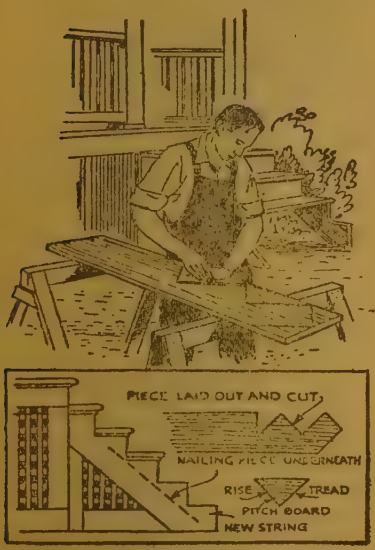


Fig. 2. The way a new "string" piece is cut out and put in place to patch old porch steps.

sidepiece or "string" is rotted at this point. If it is possible to get underneath from the rear, a batten about 1 by 3 by 18 in. long may be screwed or nailed under the loose steps, flat against the string, and the step nailed from the outside to this new support.

If this cannot be done from underneath, then a step or two must be pried up with care so that battens can be fastened to the inner faces of the strings, and the steps replaced. When the strings are exposed, scrape away the rotted portions and paint the wood.

Usually only the first and perhaps the second steps give way. To replace the step itself is a minor repair, but frequently one or both of the strings need repairing.

First measure the height of the back of the step, which is known as the "rise," and the width of the step or tread not including the nosing, or projecting overhang. Make a pattern of cardboard or thin wood from these dimensions, as illustrated in Fig. 2. This is known as the "pitch board." It is well worth while to make such a pattern even for a small repair job.

Lay this pattern on a new board of the proper width and not less than 1⅛ in. thick, preferably white pine, cypress, or other wood that is relatively durable when exposed to moisture. Then mark out the steps as indicated and allow for a slight fall of the treads to run off the rain.

Cut out the new piece of string neatly. Rip the board, if necessary, to make it exactly the same width as the old string.

Having removed the steps and risers at the bottom, place the new piece against the old and mark where the old is to be cut out. Now prop up that side of the steps and cut out the old string. Nail a 4- or

5-ft. length of rough lumber on the inside of the old string after cutting the bottom to fit on the flat stone, brick, concrete, or whatever is used as a base for the steps.

Fasten in the new section of string with nails and replace the old steps and risers, if considered in good enough condition, or make new ones. If neatly done, this repair will not be noticeable after the new wood is painted.

How to Patch a Porch Column

If a porch column has rotted away at the bottom, break off a piece of the base molding and base block to allow you to measure the exact size of the block and the diameter of the column. Also find the length of the new base and short length of column required to replace the decayed portion.

Have a woodturner make the new section of the column unless you yourself have access to a lathe large enough for the work. Be careful to have it made a trifle larger rather than smaller than the old. If it should be smaller, a neat repair could not be made, but if it is a trifle larger, it is easy to pare and sandpaper the joint down and make a workmanlike job.

It will be necessary to prop up the porch roof with a strut, as illustrated in Fig. 3, to take the weight off the column. One or two braces may be nailed from the house to the column to keep it plumb when it is being cut.

Measure exactly the combined height of the base block and short length of column and mark where the old column is to be cut. Nail on the column two strips to guide the saw, as shown; they must be quite level. If your saw is sharp and fine and the end of the new piece of post is turned true, the joint should require no fitting. The base block, however, will have to be fitted to the bevel of the porch floor, although this may be but a trifle.

If the porch floor under the column is decayed, repair it as described in the following section. Paint all joints before putting the new work in place. Only a few wire finishing nails are required to hold the new base in place. Paint it to match the old work.

Fig. 3. Sawing out the decayed base of a porch column before inserting a piece turned to fit.

Methods of Repairing Porch Flooring

About the time repairs to a column are required, not only will the flooring under it need fixing, but it is probable that other sections of the floor will require attention. These parts are usually in the front of the porch, so that it is rarely necessary to cut out entire lengths.

There will be two or three joists below, to which the floor is nailed. By driving a nail through the bad parts, the position of the joists can be located readily. Having found their position, bore as close to each joist as possible, with a brace and ¾-in. bit, and then cut across with a compass saw. Bore more holes about 18 in. nearer the front and split out the piece of flooring. Remove the rest all the way to the front edge by splitting or driving. One of the old boards is now out; to cut out the rest is simple.

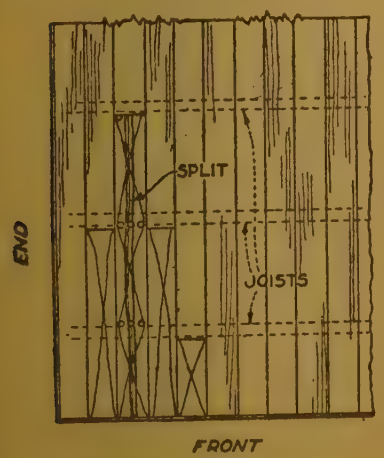


Fig. 4. The first piece of flooring is removed by boring, sawing and splitting; the other pieces are merely cut out.

Do not make all the joints on one joist, but vary them as shown in Fig. 4. To give a rest for the new pieces on the joists, it will be necessary to cut back with a chisel, or a short batten may be nailed alongside the joist, as is sometimes done in floor repairs of all kinds.

As a general rule the flooring may be obtained matched to the exact thickness and width at the mill. If you are the fortunate possessor of a small power saw, you can readily make the tongue and groove yourself to a perfect match. The last piece of the patch should be driven in from the front and nailed with finishing nails from the surface. Paint all joints before nailing the pieces in place.

How to Patch Siding

Siding, as the boards which cover the exterior of a frame house are called, rarely rots. Through long exposure, however, it becomes very brittle, especially if left unpainted.

As moisture will enter in cracks in the siding and cause the paint to blister and peel, and possibly lead to serious rotting of the framework that supports the house, it is essential to make repairs promptly.

When many splits and loose nails

are found, especially at a corner of the building where the corner boards show signs of rot, you may be sure that there is some opening which lets in moisture freely. This must be looked for and remedied. The opening may be quite a distance up, even at the roof gutter.

When the corner board is removed, often the corner post will be found rotted. If the plaster in the room inside is sound, it will not be necessary to cut a complete section of the post out. Chop out the rotted part roughly and patch the post with a piece of two-by-four or other rough wood. When a house has sheathing boards under the siding, the corner post may be decayed a little without greatly affecting its stability, but this is not true of the sills (*C*, Fig. 5).

If it is seen, after removing a piece of the corner board at the bottom, that the sill has rotted away, remove a section of the water table and bevel cap as far as the decay goes, and replace with a new sill; this usually measures 4 by 6 in. If the old sill is so badly decayed that the corner posts and studs have sunk slightly into it, the side wall should be jacked up while the new piece is inserted.

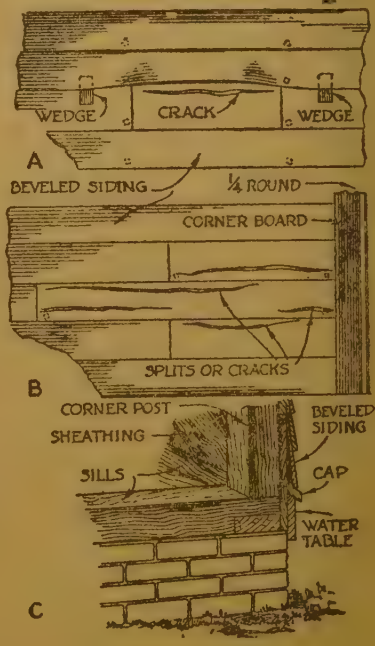


FIG. 5. How cracked or split pieces of beveled siding on the wall of a house are cut out and replaced. Unless these repairs are made promptly, the corner post and main sill may rot away.

The difficulty in repairing beveled siding lies chiefly in removing the split pieces and the nails which hold them. Drive a wide, thin chisel or, better still, a thin iron pry bar gently under the edge of the piece just above the one which is cracked. Pry up about ½ in. and insert two small wedges or blocks (*A*, Fig. 5). Then, with the point of a compass saw, cut out the piece to be removed, after marking guide lines with a small try-square.

With a cold chisel bend slightly each nail passing through the piece of siding that has been raised by the wedges; then remove the wedges and tap the piece back in place. The heads of the nails will be forced through the surface so that they may be gripped with a claw hammer. Some mechanics prefer to drive the nails right through the siding with a nail set, but that leaves a large hole and had best be avoided wherever possible.

A new piece now must be marked with a square and cut to make an exact fit. Tight joints are imperative in this work.

If a number of pieces are to be cut out, one below the other, begin at the top. In no case in the finished work must one joint come directly over another; the joints must be broken as in *B*, Fig. 5.

As corner boards and quarter round molding are of varying dimensions, the new pieces will have to be made to match the old. Cut off the old corner boards square across, but have the saw tipped upward, if possible, to give a beveled cut at the joint and, of course, cut the new piece to match. Set the nails for puttying and give a priming coat of paint at once.

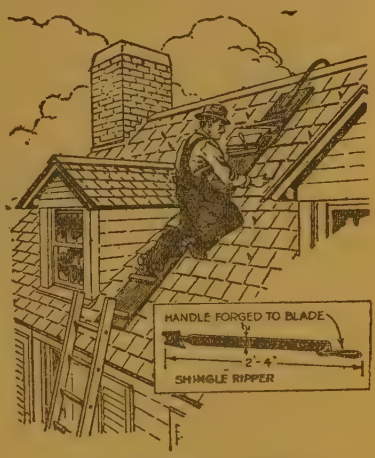


FIG. 6. Roof "creeper" and tool for removing hidden nails.

How to Repair Wooden Shingle Roofs

In repairing a roof it is of primary importance to ascertain the spots where the leaks originate. That sometimes is the most difficult part of the task. It often calls for careful sleuthing in the attic, with faint water marks for clues.

A leak may be found quite a distance from the defacing rain stains on the ceiling and walls of the room

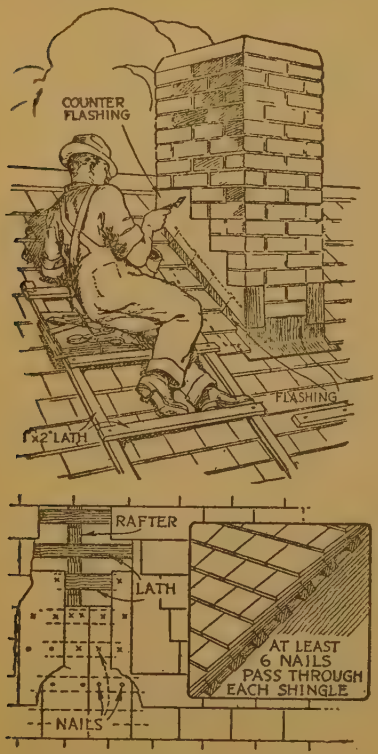


FIG. 7. Upper view—cementing counter flashing in place. Lower view—how shingles are laid and where the nails usually are placed.

beneath. At times rain water will follow down a rafter or roof board a long way before leaking into the house. The attic right under the shingles affords the best information

When the leak or leaks have been traced, push a thin wire finishing nail up through the shingles to indicate on the outside where the patching must be done.

If it is not possible to examine the underside of the roof and the outside alone must be the guide, look the shingles over carefully just above where the leak shows in the room below. The shingles may appear to be sound there; in that case, search higher up wherever it seems likely that the rafters or boards may carry water down after it has penetrated beneath the shingles.

The first thing you will ask when you come to undertake the repairs is: "How shall I get up and work on the roof?"

An iron roof hook, which goes over the ridge, may be obtained at many hardware stores. This is fastened at the end of a light ladder, which is pushed up on the roof until the hook drops over the ridge. In place of a ladder, a long board with evenly-spaced cleats, sometimes called a "creeper," may be used.

Another method is to nail a sound 1 by 2 in. shingle lath (these commonly come in lengths of 12, 14, and 16 ft.) on to the butts of the shingles so that an eightpenny nail will go through into the shingle lath below. Do not drive the nailheads right in; let the heads project so that they can be gripped and drawn out easily.

Laths made in the form of a ladder, only wider than usual, may be

used as illustrated in Fig. 7. Drive about four nails in the roof to hold this support in place. When these or any other nails are withdrawn from the roof, each of the holes should be stopped with roof cement. If the nails have been driven into but not entirely through the shingle lath (and not right through the shingles into the attic) there is little danger that a leak will develop, even when no roofing cement is used, but it pays to be on the safe side.

Shingles may be bought by the bundle from any retail lumber dealer. There are between 200 and 250 shingles in a bundle. The lengths are uniform and should be 18 in. for roof shingles and 16 in. for wall shingles. The widths, however, are random and vary considerably. Shingle nails, preferably fourpenny in size, are used for fastening the shingles. Although common nails serve well, 1½-in. galvanized nails are better as they do not rust.

Be sure to have on hand heavy tar paper, a tarpaulin or something of the kind to close up the opening in the roof quickly in case of a sudden storm.

One of the simplest types of repair is when there is a crack through two shingles, one right above the other. This may be mended by pushing strips of painted roofing tin about 7 in. long up under the shingles. If the strips

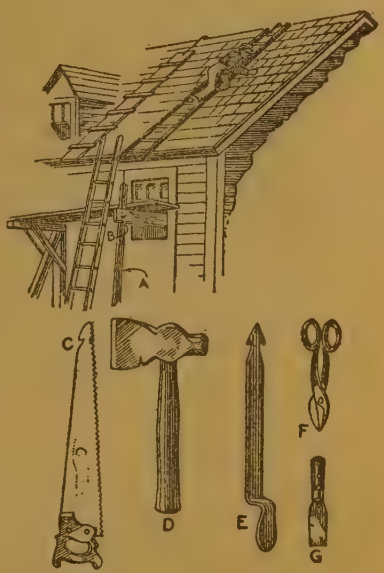


FIG. 8. Suggestions for building a scaffold, and some roofing tools.

are put in the full distance, they will, in effect, overlap each other and shed the rain.

If the shingles are too far gone and one or more new shingles must be inserted, remove the old shingles by splitting them up with a hatchet or chisel. Hammer them into small pieces and no trouble will be found in taking them out quickly, bit by bit.

Before the new shingles can be placed, however, the old nails must be removed. By examining Fig. 7, it will be seen that at least six nails have had a grip on each shingle; wide shingles have more. Four

or more of these nails must be either broken off, bent over and flattened down, or drawn out. A tool used by slate roofers and known as a ripper will serve to draw them out, no matter how far they are hidden, but it is not a tool easily obtained. Many carpenters also carry long, thin, narrow saws tempered to cut nails in repair jobs of all sorts, when these nails cannot be reached otherwise.

The work can be done with a thin pry-bar or a long, thin prying chisel. Drive it up against the nails to break them off, or bend them over and flatten them. In removing old shingles to make a patch, break out the top ones first, and the others will come easily. In breaking out the old shingles be sure to leave overlapping pieces so that no two of the new joints will come one above another.

Figures 6 and 7 show the method of shingling. You can see just what to do, in any case, by observing the way the original shingles were laid.

Begin at the bottom of the patch with the new shingles. Use galvanized or copper nails for any surface nailing. Some surface nailing must be done in repair work.

Flashings That Leak

Water often gets in around chimneys and walls because of rusty or defective flashings. The flashings are strips of tin, copper, or other sheet metal which are laid against the brick and go under each shingle as it is placed. A penknife point pushed down on the flashing, especially if it is of painted tin, will often disclose that it has been nearly destroyed by rust.

Materials for repairing flashings are: copper or tin, fourpenny galvanized shingle nails, and a few eightpenny and tenpenny common nails for nailing flashing into the chimney. Often upon a repair job the liberal use of asbestos or elastic roofing cements will do well enough as a makeshift for repairing flashing instead of using solder.

Be very careful that no nails are driven into the flashing lower than necessary, say 1 in. from the top edge of the flashing, or a bad and invisible leak may result.

To make a good repair, take up a narrow strip of shingles, put down new flashing, and replace the old shingles or put on new.

The flashings, if of tin, should be well painted on both sides and allowed to dry before being used. They should be about 6 by 8 in. and are bent and applied as shown in Fig. 7. One is placed under the end shingle of each course as it is laid, so that the flashings overlap each other. Except on the chimney or wall side, they are hidden from view when laid.

As shown in Fig. 7, the mortar is raked out from between the

bricks where necessary and the counter flashing is turned in about ¾ in. This metal is fastened in the joints with wall hooks or tenpenny nails and the cracks are filled with lead or elastic roofing cement.

Standard roofing cements alone will often make a serviceable repair over imperfect flashings at chimney or walls. They must be applied when the roof and walls are clean and dry. In the section on the repair of tin roofs further illustrations may be found.

Leaks in the Valleys

We now come to what is the most difficult repair on a roof—when a leak is found down the valleys. A valley is an angle or gutter formed by the meeting of two roof slopes and usually is laid with a continuous one-piece strip of painted tin or other sheet metal from top to bottom.

By pressing a sharp point against where shingles and flashing meet, you can tell if the metal has been eaten through. Remove and carefully store the shingles if they are sound enough to be replaced. In any case, keep one to show the angle cut. Note, too, just how they were originally laid. Have a tinsmith lay a new flashing down the valley. A chalk line then may be drawn from top to bottom as a guide in re-laying the shingles so that a workmanlike job may be done. This work requires some care and patience and should not be attempted before practicing on straight patches.

All other shingling repairs on roofs or walls can be accomplished by observing these suggestions and studying the method used in the old work that is to be replaced. (Fig. 7.)

Hints on Scaffolds and Tools

Unless one feels perfectly safe, a light scaffolding may be built, as suggested at *A*, Fig. 8. The inner end of the ledger *B* may be fastened with eightpenny common nails. Let the nailheads project so they may be easily drawn with a claw hammer. This scaffold will give a feeling of security to one not accustomed to working around high places; and in any case, the shingles at the lower edge demand more attention than those higher on the roof. Many of the worst leaks may be reached conveniently from the scaffold.

Of the tools illustrated, the ripper (*E*, Fig. 8) has already been mentioned. A notch may be filed in the back edge of a narrow, pointed cutting-off saw, as at *C*, to slip under shingles and cut off nails in the same way. The saw itself will be used in fitting hip and valley shingles. Tin shears *F* are needed to cut sheet metal for

flashing and for making tin shingles. A putty knife *G* or an old case knife will serve for applying cement around the flashing. A small hatchet *D* or a claw hammer and a wide, sharp chisel are other necessary tools.

A pair of rubbers or "sneakers" should always be worn while working on a roof, for they greatly decrease the danger of slipping, shingles will not be so badly broken, and it is possible to walk over roofs not steeper than one-third pitch.

One objection to the use of new shingles is the color contrast between them and the old roof, which gives the roof a freckled appearance. This may be helped by bringing the new shingles to about the same color as the old with a thin stain of linseed oil and turpentine, half and half, with a little japan and some dry color, such as lampblack or burnt umber. Asphaltum thinned with turpentine will serve the same purpose. By the time the stain has disappeared, the weather will have so equalized the colors that the repairs will be noticed by few.

Often in repairing hip or valley shingles, tin or asphalt shingles will be all that is necessary. Hip shingles rarely give trouble, as the water runs away from them, but if any have been blown off or been badly split, the method of re-laying them must be governed by the way they were laid originally.

Asphalt Roofing for Patches

The foregoing methods of repairing shingled roofs are standard and in regular use, but here is a method of using nothing but common, single-ply asphalt roofing with, perhaps, a little roof cement here and there around chimneys and elsewhere. The old shingles must be reasonably sound, with leaks that are the result of nothing more than splits and openings. The method is the same as if painted tin slips were used, as already described.

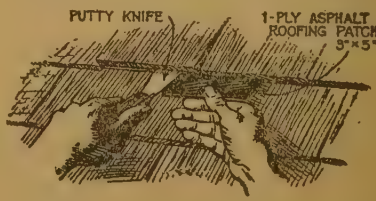


Fig. 9. Slipping beneath the shingles a patch cut from asphalt roofing.

The single-ply asphalt roofing is cut into slips long enough to reach from the butt of the shingle up to the first row of nails. Lift the shingle up just far enough to allow a slip to be pushed in place as shown in Fig. 9. The sun melts the asphaltum sufficiently to stick the slip in place. No nails are needed.

There is one further advantage: to patch an old roof with new shingles here and there gives it a spotted, unsightly appearance un-

less, indeed, they have been carefully stained or weathered beforehand, as explained in a previous paragraph. The slip shingles, on the other hand, cannot be seen.

When a roof has to be patched, unroll the roofing on a floor or other level place and brush it well on both sides with a broom to prepare the surfaces so that they will stick readily. Then, with a pair of compasses, a straightedge, and a sharp scratch awl, divide the roofing into rectangles 3 by 5 or 3 by 6 in. These practically fall apart after being scratched, but, of course, tinner's snips could be used to cut them apart, if preferred.

Slate and Asbestos Roofs

Go over the surface of the roof carefully and remove all slates that are cracked crosswise of the slate. Use the tool called a "ripper" (see Fig. 8).

Insert the working end under the broken slate and move it back and forth until the nail holding the slate in place is firmly seated in one of the hooklike notches. Then by jerking down sharply the nail can be cut. If it is too stubbornly set, the upper end of the handle may be hammered. A nail-cutting saw, now easily obtainable, will serve very well instead of a ripper. Insert it under the slate and saw through both nails.

In the crack or joint directly

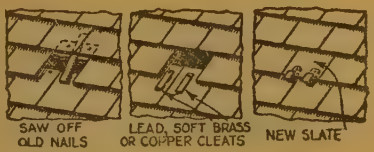


Fig. 10. Metal clips are nailed in place to hold a new slate.

under the slate that has been removed, nail a piece of copper or soft brass about ½ in. wide and 4 in. long in such a way that the lower end will project 1 in. below the lower line of the course where the new slate is to go (Fig. 10). Then slide the new slate up even with the other slates in this course and bend the copper clip up in hook fashion.

If a slate must be cut, lay it along a stone step or a square piece of iron and cut it with an old file or hatchet by using short, sharp blows. Holes can be punched with a sharp nail or punch. If any large amount of slate must be cut, it is best to employ an experienced slater or to purchase a set of slater's tools, which consist of a hammer, ripper, and stake. The latter is a T-shaped, flat steel anvil.

It is advisable to make plentiful use of good roofing or "slater's" cement and painted tin strips in every suspicious looking place, as fully described for wooden shingled roofs. Slide the tin strips under the cracked slates; no nailing is required.

If your roof is tile, by all means

get an experienced roofer. Tile roofs are difficult to repair because the tile must be laid to allow for expansion.

Asbestos shingles are so durable that they do not need to be replaced, but occasionally one will be broken through accident. The

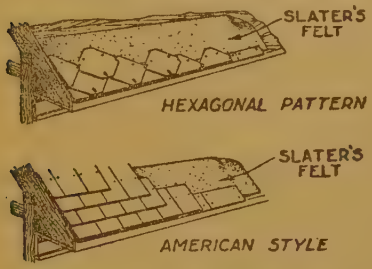


FIG. 11. Asbestos shingles, which are laid in two standard ways, rarely require repairs unless accidentally broken.

broken shingle is removed and a new one placed in exactly the same way as described in slate roof repairs. The new one is held in place with a strip of copper or lead.

Asbestos shingles are cut differently from slates. Score deeply along the line to be cut with the edge of an old chisel, a large sharp nail, or any pointed tool. Lay the shingle over a bearing surface that has a good edge. See that the scratched side is up and let the waste part overhang; strike it a smart blow with the hand. There is a device known as an asbestos shingle cutter for those who do much of this work.

However good any roofing material itself may be, the flashings may need attention because of the settling of the house or other causes For directions as to this see page 18. Two methods of laying asbestos shingles are shown in Fig. 11.

How to Repair a Composition Shingle Roof

As in the case of asbestos roofs, the life of the better grades of modern composition shingles has not yet expired and few repairs are needed.

When composition shingles of the lighter and poorer grades have been used, high winds may cause trouble by driving the rain under them. This can be remedied by raising the shingles carefully and painting beneath them with a good grade of asphalt paint or the paint that is furnished with roll roofing and used to cement the joints. Care must be taken, however, to apply paint only where it will be covered by the shingles. This method will seal all but the very poorest composition shingle roofs and renew their life for years.

If the slate surface of shingles is worn off or badly discolored, it can be renewed with one of the various coatings manufactured for this purpose.

If these coatings are unobtainable locally, mix the following for each 100 sq. ft. of roof to be renewed: 1 gal. turpentine as-

phaltum, 1 gal. bright red, green, or other house paint, according to color of roof, and 1 qt. turpentine. Stir thoroughly and apply heavily. Do the painting on a very warm day, if possible. Allow at least sixty hours between coats. This paint will renew the color and, by soaking into the felt base of shingles, will restore their waterproof qualities.

If the roof leaks near chimney and valleys, or at flashings, this can be stopped with one of the various roof cements or with a homemade preparation consisting of 1 qt. of asphalt paint or house paint of a color to match the roof and enough asbestos plaster, obtainable from any plumber or steamfitter, to make a mixture of the consistency of putty. With a putty knife or trowel, apply it to all interstices of shingles in the vicinity of the leaks.

When shingles are badly curled, only the application of a new roof or the rather drastic method of nailing them down flat with coated or galvanized nails and painting the entire roof will suffice. Before applying one of the preparations made for painting composition roofs or the paint previously described, be sure that all loose, curled, and raised shingles are nailed down. Do the work on a warm day, in the sun if possible. Naturally, the last method of painting over an old roof will serve only when appearances are of no importance.

How to Lay Roll Roofing

Roll roofing is a very common form of covering for all kinds of low-pitched roofs and roofs that are almost flat. Shingles of all kinds, as well as slate, should never be used on a low-pitched roof, for a stiff wind may blow the rain right up underneath them after the shingles have been on a season or two.

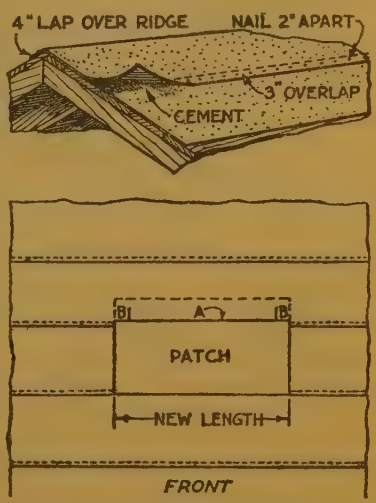


Fig. 12. One standard method of laying and patching roll roofing.

There are various methods of laying this roofing. Some lay it in lengths from ridge to eaves; others prefer to lay it across the building starting at the ridge; others like to begin at the eaves and work up. Much may be said

in favor of each method. Figure 12 shows a common way of handling this work.

Various degrees of thickness are obtainable. Two-ply is in general use except for very common or temporary purposes, when one-ply will serve. A great many varieties are manufactured, some much more costly than others. It is well to read the manufacturers' circulars before choosing a brand for the purpose you have in mind. A can of cement and nails sufficient for laying each roll are usually inclosed in the roll.

The can of cement should be pierced at the top with a stout nail in the same manner as a household can of evaporated milk is pierced so that the cement may be poured out without loss.

For a large roof the roofing may be rolled out and placed one piece at a time; for small roofs a number of pieces may be cut before laying any, as with wall paper. Allow sufficient for turning over at the ends and edges.

Do not skimp the overlap; allow 3 or 4 in. at least. The width of the lap settles itself if you divide up the span, as a mechanic does, so that the exposed parts are all of the same widths. It may give a little more lap than is called for, which is a "good fault" in this work. Thus, it is better to cover with five full widths, all spaced alike, than with four and three quarters. The strip, if cut off, is not of much value.

When two pieces are in place with the top, of course, overlapping, a light chalk line may be run along the edge. Have a helper lift the overlapping edge as you carefully run the cement along just above this line. If you do this, the work will not have a messy appearance when the lap is nailed down. Usually the nails are spaced about 2 in. apart. Always begin nailing from the center of the strip; never start at the ends.

When Roll Roofing Leaks

Small holes may have a small patch cemented and nailed on, or they may be covered with standard elastic roof cement. Bad spots, often caused by much walking upon the roof, require a larger patch, which must be applied with care to be waterproof. Probably the simplest method is that shown in Fig. 12. Begin by cutting with a sharp knife on a line *A* at the top, just above the roof nails. Make two short cuts as at *B*, a few inches from each end of the patch. Lift the long piece *A* and raise the two small corners *B* diagonally so as to permit the new patch to be slipped under to about the position shown by the dotted line.

The old roofing is usually very brittle and must be handled with care or it will tear. A warm day,

in the sun, is the best time to do this work.

Having placed the patch in position, cement it well with the roll roofing cement under the flaps before nailing the top. The weakest points are at the extreme edges of the patch in the neighborhood of the points marked *B*. A short strip of roofing slipped between the patch and the old roofing at these points will reinforce and strengthen the patch, but do this with care or the old roofing will tear in your hands. Having cemented under all edges, as in new roofing, nail them in the same manner with properly coated roof nails.

If chimneys, parapet walls, or gutters are encountered, refer for directions as to flashings to the sections on tin roofs and wood-shingled roofs.

Patching Tin Roofs

Today there are good methods of repairing tin roofs which are not the tinner's way. It would not be wise for one entirely inexperienced to attempt the tinner's method of repairing, particularly as special tools are required; such as a heavy soldering iron, a gasoline furnace, a blowtorch, and other equipment. A knowledge of the proper fluxes and how to use them and familiarity with many other technical points are also necessary. Experience in soldering radio connections will not suffice for this work, where someone stepping on an imperfectly soldered joint may cause a crack which in turn may cause a very expensive leak. Of course, small holes or split seams—a fruitful cause of leaks—may be soldered or patched without much difficulty.

Tin roofs are usually kept in repair by brushing over them a fresh coat of special paint made for tin, which can be obtained almost anywhere. Usually, if the surface has been kept properly painted all the time and yet allows water to leak through, it will be found that the rust has eaten up from the underside. When a tinner turns up a strip of old tin roof, large patches of rust will be seen on the underside. Exterior painting with regular paint will not save the tin in this condition, but in recent years special heavy roofing paints of a tough fibrous nature have been in use for preserving old roofs.

One way of fixing leaks in a tin roof is to cover it with standard roll roofing. The method followed is the same as described in the section on roll roofing, except that a box gutter and a parapet wall are often encountered. The treatment of the chimney must also be different from that described in the wood shingle section. Many are content to fit the roll roofing tight against the chimney and put all around it, well overlapping the roofing, a heavy layer of standard

plastic roof cement—not the roll roofing cement. If the roof is so placed that it is not treated too severely by the weather, you may perhaps let it go at that, provided you renew the cement in the course of time, as may be required; it has been known to serve for many years without attention. But the safer way, for all weathers, is to apply a flashing in the following manner:

Cut out four pieces of the roll roofing 15 in. wide for the sides of the chimney, allowing 18 in. more on each piece for the overlap (9 in. at each end). Put them in the sun or in a warm place to get soft; then turn up 6 in. to be placed against the chimney. To cut these pieces to fit and make a neat job requires ingenuity and care, but the same general principle is used as in cutting a paper envelope or box before folding. (See *A*, Fig. 13.) A cut carried a little too far ruins the piece for this purpose. Bed all around the corner, where roof and chimney meet, with plastic cement so there will be a solid rest for the roofing, or use a triangular wood strip to fill in the angles. This will prevent the ice from breaking through at the turn. As roll roofing should not have so abrupt a turn as metal, it needs support.

Fit the piece at the lowest side first, cementing well at edges at both roof and chimney; nail into

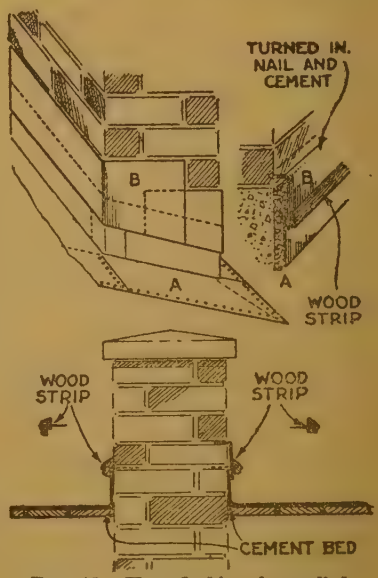


FIG. 13. How flashing is applied around a chimney and a parapet wall in repairing tin roofs.

the brick courses near the top edge. Next fit the sides, overlapping the bottom, and fit the top piece—the most important of all—overlapping the sides. Slip the top edge under the roofing above, which, if it has been laid in place, should have been left unnailed for this purpose. Having nailed the flashing all around into the brick joints, apply a heavy coating of plastic roof cement on the top edge. If the nailing in the brick joints does not appear to hold well, a wood strip may be put on with longer and heavier nails, being back cemented first (Fig. 13). Fin-

ish by nailing around on the roof.

It is rarely that a counter flashing, as at *B*, Fig. 13, is required in work of this nature, but if it is it may be made out of roll roofing provided it is securely fastened so the wind will not tear it. Copper or tin, however, can be fastened with more certainty and are easily obtained. Coat all heads of nails and all wooden strips with cement.

At a parapet wall the roofing should be turned up far enough to reach the joint of a course of brick. It should be bedded in the corner with cement or a wooden strip as described for the chimney, and then nailed along the brick course. A strip of wood, backed with a layer of cement, should then be securely nailed on as in the lower view of Fig. 13. A counter flashing sometimes is added. Rake out the joint of a brick course above, turn the edge in, secure it with nails, and cover with cement as at *B*. If there are any angles in the wall, the corners must be cut and folded as described in a previous paragraph.

A box gutter must be lined before the roof near by is laid. The opening for the tube leading to the downspout should be countersunk for the flange, and before the lining is put in should be well cemented so that when the flange is set and screwed down it will be waterproof at this point.

Measure the bottom of the box and two sides and allow enough to bend over to the front edge at top and 8 in. more to turn over roof. If possible cut it all in one length, allowing for folded ends. Having allowed sufficient by measure for the front side and overlap, make two light chalk lines the width of the bottom and fold the piece over the edge of a board, having previously warmed the roofing. Cut the ends as a paper box is cut before folding. Cement and

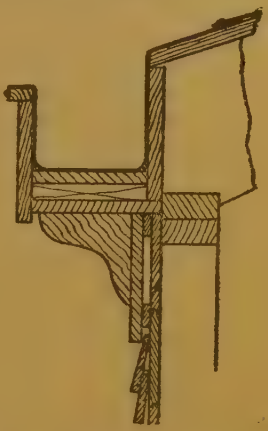


FIG. 14. Typical box gutter, showing the lining.

nail securely at ends, and then nail along the front edge. The roof piece is not nailed, as the overlap secures it. As before mentioned, bed in the corners with cement or run a small beveled strip of wood along the angles at the bottom. A plain outline of this lining in a common box gutter is shown by the heavy lines in Fig. 14.

How to Repair Sills

House sills are timbers laid on the foundation walls, on which, in a frame house, the superstructure is reared. A sharp-pointed knife pushed into the water table, drip molding, or corner board will usually disclose any decay and the cracking of the plaster on the inside is also often an indication. General directions on how to repair this condition were given under the heading "How to Patch Siding." Helpful suggestions for the easy removal of the decayed timber are given in the next section and are illustrated in Fig. 15.

Porch sills generally rest on piers. If the column is decayed, or the porch floor is left in disrepair, water seeps in and gradually the sill decays, usually starting at the corners. If the facing board, together with the molding under the floor projection, is cut over the pier and removed, the condition will be revealed as shown in Fig. 15. Even if the decay does not extend very far, the sill must be cut back to the next pier.

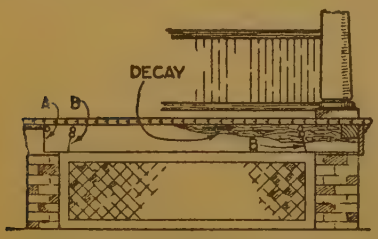


Fig. 15. How a decayed porch sill is cut away to allow its replacement.

On account of the many nails which pass through the flooring into it, the sill is difficult to remove. The easiest method is as shown in Fig. 15.

First remove the lattice frame. Make a square cut over the pier at *A*, then two other cuts at an angle as at *B*. Do not cut these square or the timber will bind in the removal. Bore holes at the top of the *B* cuts so that your compass saw may enter, or bore all the way down without sawing.

Having done this, it is a simple matter to force the decayed timber down and off with a "pinch" or pry bar and to split out the two short ends that are left. Break off the protruding nails (do not drive them up) or, better, pull them with pincers from below.

Fit and place the new sill, fit the finishing board and the cove or other molding in the front, and face-nail each piece of flooring from above. Replace the latticework and the repair is completed.

Door sills of private residences rarely require renewal, but the "threshold" or "saddle"—a strip of hardwood from 4 to 5 in. wide and usually ⅝ in. thick, with molded or beveled edges—often needs replacing. The wood may be bought in suitable lengths at any mill where trim, sash and doors are sold. Lumber yards often have it.

To remove the old, worn saddle, make two cuts at an angle as shown at *A*, Fig. 16. Pry off the long piece and split off the short ones.

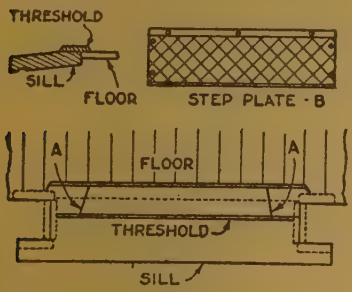


FIG. 16. Method of repairing a threshold; an iron sill plate.

Break or draw out the old nails and fit in the new piece, nailing it securely. Before doing this it is well to set compasses to the full thickness of the threshold, shut the door, and run them along the sill, one point touching the sill and the other point or pencil traveling in the air vertically above the lower point. If the upper point or pencil leaves a mark on the door, it will be necessary to take the door down and plane the bottom until it is slightly above the mark, otherwise the door will bind when the threshold is in place.

When much traffic passes over a small section of the main sill, as in apartment houses and stores where one of a pair of doors is constantly used and the other at rare intervals, the sill at this point may become so badly worn as to require a new one. To remove this heavy sill, use the same method of making angle cuts, prying out the large piece, and splitting the short pieces as employed in removing the threshold. The new sill may be obtained at a woodworking mill ready to be put in place. It should be fitted with care and well wedged up from the house sill or the joists tightly against the door frame jambs (vertical side members).

A good method of repairing the main sill when worn as just described is to attach an iron plate, made with a lip or nosing, as shown in *B*, Fig. 16. If your hardware dealer cannot obtain a plate for you, you can procure one from a foundry, cut to the right length, with screw holes drilled and countersunk to your order. They are made in varying widths: 8 or 9 in. will suit an ordinary sill. They are not expensive as compared with the cost of putting in a new sill.

To fit one of these plates, place it in position on the sill and mark carefully around it. With saw, chisel, and hammer cut, chip, and rout out the wood to the depth required, ⅜ or ½ in. being the usual thickness. The cutting may be quite rough, as the plate may be bedded in with cement as nearly flush as is possible in an old sill. Do not confuse these plates with the thin metal plates in common use to protect the treads of stairs.

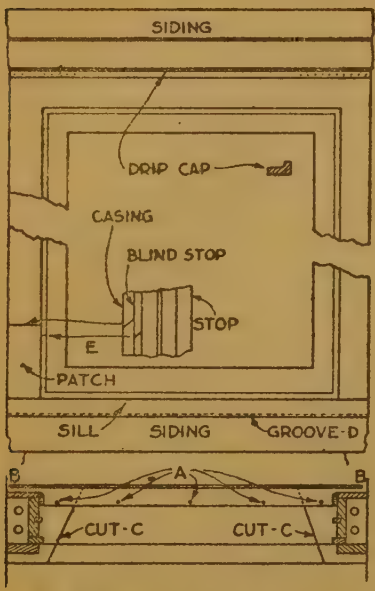


FIG. 17. How an old window sill is cut away and a casing patched.

REPLACING WINDOW SILLS

Window sills often rot. Generally it is because the wood used in making the frames was sappy or of the wrong kind or because water seeps in. Regular window sills are made up of a sill that is usually 1¾ in. thick and a ⅞ in. thick sill on top of and partly overlapping it (Fig. 17). Casement frames have but one sill, but the repairs are carried out in the same way in both cases.

It is often possible to cut out a small section of decayed wood and fit in another piece, bedding it in white lead paint. As a general rule, if the sill is decayed or split, it had better be removed.

First find the nails which are driven through the window stool (see *A*, Fig. 17). The stool is a finishing piece which rests on the sill on the inside of the window. With a fine nail set or other tool drive the nails right through into the sill below. Now lay a flat piece of wood on the wall plaster near the end of the apron (*B*, Fig. 17) and pry off from both ends with a wide chisel. In this way stool and apron—the finishing piece below the stool—may be removed together, without breaking the plaster. With pincers draw the nails through from the back or else break them off; do not mar the wood by driving them back through the face. Make two angle cuts with a coarse saw as shown at *C*, Fig. 17, and it will be easy to pry out and split the old sill left at the ends.

New sills of the required length may be obtained at the mill ready to be put in place. The thick sill should be placed first so that you may "work" it into position in such a way as to allow the siding to enter the groove (*D*, Fig. 17) in the bottom of the sill. If this is difficult to do, chip a little wood from the back of the groove on the bottom of the sill. When both sills are in place, wedge them up

tight to the frame. Carefully replace and nail apron and stool.

When the outside casing and blind stop are decayed for a few inches, it is not necessary to place an entire new length; a short patch, neatly done, will be unobserved. Make the cuts at an angle as shown at *E*, Fig. 17, to run off moisture.

The drip cap at the top of the frame may let in water and need repair. Remove a piece of siding above it by the method shown in the section on the repair of siding and replace with a new cap. For better protection, cover this with copper, tin, or standard roll roofing; nail it at the front edge of the cap and turn up 3 or 4 in. at the house wall before replacing the siding.

The sidepieces (hanging stiles) of a brick frame should be caulked at the open joints with oakum and plastic cement.

How to Fasten Woodwork to Brick and Stucco

The old-time method of fastening flower boxes, screens, and other woodwork to brick, stucco, and other masonry was to drill the hard-surfaced wall with a brace and drill bit or with a "plugging" chisel and then drive in a soft wood plug to receive the fastening. This method is still used, and is very good where nails are to be driven in, especially if they are driven at a slight angle. An end grain plug, however, is not good as a permanent fixture for screws or bolts, although it may serve temporarily. Another favorite and useful way was to drill a hole as described above, put the fastening in, and pour melted lead around, or roll up a strip of thin sheet lead to fit the hole and turn the screw into it. Modern devices have now largely superseded these methods. Among them are the following:

Cement. A cement that hardens, and looks like iron. It is mixed in water, placed in the hole, and the screw is driven in while the cement is soft.

Expansion Bolts. Bolts having a nut made of movable parts which expand in the hole when the screw or bolt is turned in.

Fiber Wall Plugs. A fibrous plug which, when inserted in the hole and the screw driven in, has a very strong grip. (See 92.)

Brass Threaded Nut for a Screw. A device having a knurled outer surface, which is intended to be driven tightly in the hole by means of a special driving cap. The nut is threaded on the inside to receive a screw. These plugs are made in

many sizes to suit wood screws by number and bolts by diameter.

It should be remembered that a hole drilled to receive a plug of any kind should be enlarged slightly

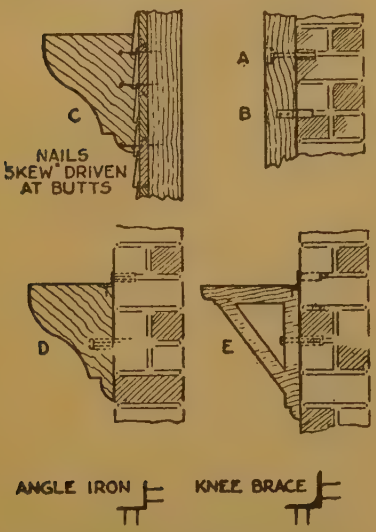


FIG. 18. Methods of fastening flower boxes, screens, and woodwork to siding-covered walls and to brick, stucco, and other masonry walls.

at the back end so that it is wedge shaped. This may be done in small holes with a nail set or any pointed tool. Nonrusting, noncorroding metal screws or bolts should be used, if possible, in all exterior attachments to walls. These are not difficult to obtain. A small, uncoated iron screw will cause a long line of discoloration to run down a wall or fixture in a surprisingly short time.

A porch screen is usually fastened to the wall with angle irons or knee braces, as at *B*, Fig. 18. The screen should be held in position and marked carefully at the brick joints, the joints also being marked to show with exactness just where the screws are to go. The wall is then plugged by one of the methods suggested. When the screen is made and the work laid out, it is better to make allowance for a separate strip of wood 2 or 3 in. wide to be scribed (fitted) to the wall and the angle irons placed on it. When this is done, screws are sometimes set straight through from the outer edge of the narrow strip, as at *A*. The same general methods serve for attaching brackets for flower boxes, lattice frames for vines, and other wall fixtures.

In Fig. 18 will be seen how to locate the fastenings. With shingles or wood it is required only to hold the bracket firmly back to the wall, as the bevel on shingle or siding supports the weight; therefore a few long finishing nails driven slantingly as at *C* are sufficient.

The same bracket is secured to a brick or other hard-surfaced wall by putting a bolt in the wall, locating the position of the bolt on the back of the bracket, and boring a hole to receive it. A small angle iron at the top keeps the bracket from coming forward or moving sideways (*D*, Fig. 18). Let the iron flush into the top of the bracket

and notch the back of the flower box for the wall part.

Open brackets are secured as shown in *E*, Fig. 18, on both wood and brick walls.

Hollow walls of tile, cement blocks, and the like are plugged in the same way. Care, however, must be taken that the outer shell of the block or tile is not fractured or pieces broken off in drilling through it. For stucco on lath use long screws reaching back to the sheathing, or to the heavy 1 in. thick laths, if they were used in place of sheathing.

How to Inclose an Open Porch

If your house has an open front porch of reasonable size, you can improve the architectural appearance of the building greatly and at the same time increase its resale value by inclosing the porch. This has the effect of adding a room to the house. Indeed, the inclosed porch, which is now being made a feature in so many new houses, is utilized as a sitting room in many cases, at least during the milder seasons of the year. If radiators are provided, it can be used all year round.

There is nothing difficult about inclosing the average porch. It is a job any handy man can undertake with entire confidence of success. The main thing is to be familiar with the rudiments of the work and

Fig. 19. When you are inclosing an open porch, you are adding an extra room to your house.

to plan the construction carefully in advance.

As open porches vary in design, the columns of some being square and others being round, some having rails and others being without them, two methods are illustrated. One (shown at *A*, Fig. 20, and in Fig. 21) suggests a simple yet workmanlike way of inclosing a porch which has round columns; the other plan (Figs. 19, 20 at *B*, and 22) is for a porch that has a railing and square columns. Various modifications and combinations of the two types of construction can be made to suit individual needs.

It pays to make a sketch of what you propose to do and a tentative

list of the necessary lumber, sash and doors. Then you can find out from your lumber dealer what he has in stock of the needed materials and what will have to be made to order.

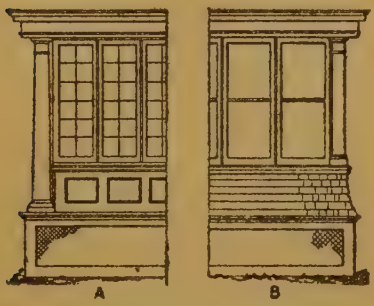


FIG. 20. Inclosed porch with round posts and one with square posts.

In the case of a porch with turned columns, begin work by removing the lower rails and balustrades. The top rail or handrail may be retained and utilized if it is 6 in. in width. If it is narrower, hammer it down 1⅛ in. and place a wider rail on top. Add a molding below the new piece to give the appearance of a heavily built rail.

The pieces marked No. 1 and No. 7 (Fig. 21), which are 1¼ by 2½ in., are the first to be fitted. Cut them to fit tightly between the soffit and rail and between the rail and floor. The fitting is accomplished by plumbing them carefully in place and marking them with scribers or compass to match the post. Instead of trying to fit them neatly to the molded base and cap, simply cut a recess in these members to the depth of about ½ in.

When the pieces have been sawed out, a half-round plane or a gouge should be used to hollow out the edge that fits against the post. Then screw these parts in place.

The next member to be erected is that marked No. 2, which is 1⅛ by 2¼ in. The stock must be rabbeted to receive the sash. Nail this member to the piece already fitted and also carry it along the top.

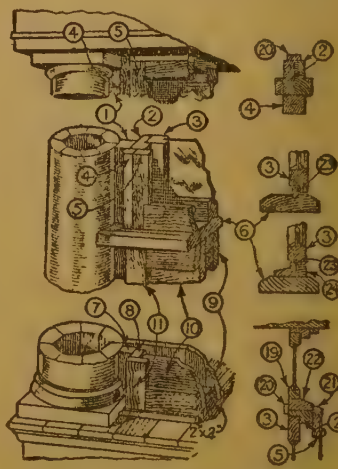


FIG. 21. A workmanlike way of inclosing a porch that has round columns.

Outside the pieces No. 1 and No. 2 and covering the joint between them is a strip 1¼ by 1⅛ in., marked No. 4. It is the hanging stile for the screens. The corresponding

member that runs across the top is only one half the thickness, or ⅝ by 1⅛ in. The screens (No. 5) fit into the rabbet thus formed.

The rail, No. 6, should have a slight bevel outward to shed the rain.

In the section below the rail, a strip, No. 8, which is 1⅛ by 1¼ in., is nailed on. Cross battens of 2 by 2 in. rough stock are nailed lengthwise of this lower section, and ½-in. ceiling (tongued and grooved) stock is nailed on the inside, as at No. 9.

The panels, No. 10, are all ⅞-in. stock. They should be screwed to the back of the frame, which should be made as follows:

The stiles, No. 11, that is, the vertical members of the frame outside the panels, are about 4 in. wide. The top rails should show the same width as the stiles, but as a piece of molding goes against them under the rails, the stock actually should be at least 1 in. wider. The bottom rail should be a trifle wider still. A heavy panel molding should be mitered around the inside edges of the stiles and rails against the panels.

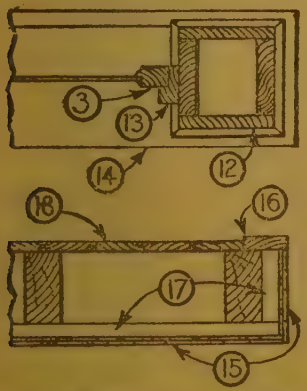


FIG. 22. Details of inclosed porch with square posts.

If it is desirable to make divisions between the columns, two pieces of stock similar to that marked No. 2 should be nailed together back to back with a piece of No. 4 covering the joint outside and a small fillet (No. 20) to conceal the joint inside. Note this detail in Fig. 21.

A headlight often is placed over the windows, especially when the porch is high (Fig. 19). This construction requires a transom bar, a detail of which is shown in the lower right-hand corner of Fig. 21. It is made up of No. 20, 21, and 22 combined with No. 2. The bar should be fitted together securely and neatly at the desired height.

Either casement, that is, hinged sash, or single sash may be obtained to suit the openings at any sash and door mill or through your lumber dealer. The sash (No. 3, Fig. 21) nearest the columns may be hung on hinges and the others made stationary with screws. If dividing pieces have been provided between the columns, all the sash may be hung so as to open. If there is a headlight (No. 19), it is nailed fast. Screens are made and fitted to go

outside. They may be kept in place by buttons or screws or with ordinary screen hangers.

The door opening will be defined by the space between the columns opposite the front door. A single door or a pair of doors may be used. Scribe pieces similar to No. 1 and No. 7 and fasten to the columns. Two jambs or posts are nailed in place between the porch floor and the soffit. Doorstops are nailed to these posts. If headlights are to be used, there should be one over the door, as over the windows, supported by a transom bar.

If it is wished to make the inside casement sash thoroughly weathertight at the bottom, they may be made as detailed in Fig. 21. The main sill, that is, the original porch rail or the piece added to it, is plowed (grooved) to allow a strip (No. 23) to be inserted, or a narrow ⅞ in. thick extra sill with such a groove (No. 24) may be added. Both methods are illustrated.

To inclose a porch by the second method, which is an excellent one to follow where the old posts are not worth saving, begin by propping up the roof with a number of struts. Two-by-fours usually are strong enough if the roof is not of especially heavy construction. After removing all rails and posts, make a new railing framework of rough two-by-fours. Leave the door opening as previously suggested, for jambs or posts will have to be placed for the door or doors, as well as a transom bar for the headlight, if one is to be used.

Plumb down from each corner of the soffit or beam above and make allowance for the thickness of the shingle lath and shingles before placing the rough framework. When the posts are finally put in position, they must line up correctly. If this allowance is not figured out accurately, the post may come either too far out or too far in at the top or else be out of plumb.

Wedge out the bottom shingle lath to suit the slight curve of the bottom shingle. Place a shingle in the lowest position and measure up 6 in. from the extreme butt in order to find where the next lath should be placed. The other laths are spaced to suit, usually from 4½ to 5 in. center to center. Allow more at the top for the space taken up by the molding which goes under the rail.

The first row of shingles should be doubled, the joints of the outer shingles covering those in the under row. The shingle lath is shown at No. 17 (Fig. 22) and the shingles nailed to them at No. 15. The corner piece, No. 16, is 1⅛ by 4 in.; No. 18 is the ½-in. tongue-and-groove ceiling and is nailed inside the bottom section to hide all evidences of the rough framework.

The cap or rail (No. 14) must be wide enough to project over all the

work so that a molding can be placed under it on each side. Boards 8 in. wide will be sufficient if the two by fours are laid with their 4-in. surface horizontal; 6 in. if the two-by-fours are laid with their 2-in. surfaces horizontal. The cap should be beveled slightly as shown at No. 6 in the first design.

If parts of the old posts cannot be utilized, new ones should be made to measure at least 6 in. square. Two pieces 1⅛ by 4 in. and 2 pieces 1 by 6 in. can be nailed together to make a good post (No. 12). To give the post a finished appearance at the bottom, nail ⅝ by 4 in. pieces at each side to form a base.

A rabbeted piece (No. 13) is carried up the post and across the head to receive the screens or sash. It should be 1⅛ by 2¼ in. The crown or bed molding and the neck molding are butted against this piece. This allows the screens and sash to be placed without scribing or fitting them to the moldings, which is more or less difficult to do neatly.

The sash, as shown in this design, are fastened in with buttons. In the spring, some or all of the sash are replaced with screens. For instructions on making window screens, see Chapter X, where methods also are given for screening a porch.

It will be seen that this plan may be modified to take both sash and screens, as in the first design.

Cutting a New Window Opening

To cut a new window opening in a frame house presents no great obstacle to the skillful home worker.

The location for the window in the room is fixed by the individual circumstances in each case. It remains to be seen, however, if in that position it would injure the

Fig. 23. Inside and outside view of opening for replacing a new window frame.

appearance of the residence from the outside. This may be judged by measuring from the outside corner of the house, allowing about 6 in. more than the distance across the room or rooms as measured inside.

Should there be a window above or below that comes almost in line with the place for the opening, keep

the new window exactly in line, if possible, even if the location is not so desirable on the inside.

If the window is smaller in height than others on that side of the house, it is usually best to make the new window line up at the top with the others, as illustrated in Fig. 23. This brings the window higher from the floor from the inside, but this is not unusual and often no disadvantage.

Before cutting the opening, tap the plastered wall to find the location of the studs or vertical members of the house frame. If by changing the position an inch or so the cutting out of one side stud can be avoided, do this; it saves much time.

For double-hung sash, that is, the ordinary sliding sash with weights, mark the proposed opening on the wall 6½ in. wider and 5 in. higher than the sash size. For example, if the pair of sash are 2 ft. 6 in. by 5 ft., the opening should be 3 ft. ½ in. by 5 ft. 5 in. If casement sash without weights is used, the allowance in width need be only 2½ in. more than the sash.

Cut out the plaster on the lines with a chisel, breaking out a strip about an inch wide to expose the lath. Then cut through the lath with a coarse compass saw. Also cut out the 2 by 4 in. studs that have to be removed.

You then are ready to work from the outside. Although at times this may be done from a ladder, it is a great advantage to rig up a scaffold opposite the opening to be cut. (See Fig. 8 of this chapter for a method of doing this.)

It usually will be best to order the window frame, sash, and inside trim complete. When doing this, request that the outside casing be sent loose. The casing then will come tacked lightly to the frame.

Measure the frame with the casing on and mark the opening carefully on the beveled siding of the house with a straightedge and plumb.

In cutting the opening, the edge of the sheathing (*B*) should project about 2 in. beyond the edge of the siding (*C*) and a section of the siding (*A*) should be removed both at the top and bottom of the frame, to be replaced after the frame is set up. The drip cap on top of the frame should be covered with metal and painted before the upper piece of siding is put in place. At the bottom of the sill a groove will be found into which the bottom piece of the siding fits. Take care to nail the casing very solidly to the wall and frame.

CHAPTER II

HOW TO REPAIR INSIDE WOODWORK

IN EXTERIOR work, the enduring and weather-resisting nature of the materials is of chief importance. In interior work, well-fitted doors and windows and woodwork of pleasing and artistic forms are desired. How to keep interior woodwork—windows, doors, floors, and stairs—in repair and how to make necessary changes and additions will be told in this chapter.

In exterior work, heavy common nails with large heads are required to hold the material against the strains of wind and weather. In interior work, light thin finishing nails in varying lengths are used, and all screws, if exposed to view, are of brass or coated or plated metal with round or oval heads.

It is no longer necessary to devise special catches, locks, and pulls, as in times past; the variety manufactured now is all that one can ask, both in utility and beauty.

Hot glue, prepared in a gluepot or double boiler, was and still is good for large work, but for the man using small quantities, often in cold surroundings, the excellent liquid cold glues are to be preferred, or the powdered casein glue will do as well.

The last named glue has merely to be mixed with water just before using, and should always be kept on hand.

Such woods are to be chosen as general custom dictates. Different woods, of course, are used in various sections for the same purposes. Your lumber dealer will always be glad to tell you what is commonly used in your locality for any job.

Basement storage bins, shelving, stairs, and the like may be of hemlock, spruce, common white and yellow pine, common fir, and similar woods. For the kitchen, bathroom, attic, and closets, where the woodwork is to be painted or enameled, a close-grained wood such as pine or whitewood should be used. For the reception and living rooms, especially if the woodwork is to be stained and varnished, fine hardwoods are to be desired.

Chestnut is, for example, an open-grained wood, soft compared to many other hardwoods and therefore easily worked; thus it is a serviceable wood for the home worker

and repairer, and can be made to appear a good match for some kinds of ash and oak. There are close-grained hardwoods, too, like maple. It is not difficult to fill the grain of these to obtain a smooth surface for enamel finishes.

In making repairs, never patch a fine piece of white quartered oak, for instance, with a piece of plain red oak. The beauty of fine woods always should be respected.

Checking Dampness and Decay in the Basement

A damp basement is most discouraging. The method of digging a trench around the outside walls, laying an open tile drain to direct the water away from the building, and coating the outside wall with hot pitch or other waterproofing, probably has not been improved upon; but after the house is built, the work is expensive and troublesome. Modern scientific research has evolved formulas for waterproof cements and coatings which the manufacturers recommend for the interior of basement walls to keep them dry. They are not difficult to apply.

Roots of trees and vines will carry moisture to foundation walls and, entering any interstices they may find, keep the walls permanently damp. If this is found to be the case, dig the roots up and cut them away.

If dampness reaches any wooden posts and piers which support the girder under the joists, these wood-destroying fungi soon attack it and destroy it at the base, causing it to sink and let the floor joists down; this in turn often causes cracks in the plastered walls on the floors above. For his own protection it

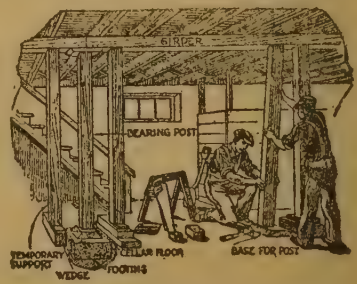


Fig. 1. Wooden bearing posts should be supported on concrete.

is important that the home owner should inspect every possible source of moisture.

If wooden uprights have rotted at the base, the first step is to place a temporary support near the first upright to be treated; this serves as a crutch to take the load from the permanent post, which has to be taken out and cut off 5 or 6 in. from the bottom. This amputation takes away the portion which has decayed and leaves a fresh end. On the floor build up a 5-in. bulge of concrete on which the support may rest when it is placed back in position. Ample time must be allowed for thorough drying before the upright is replaced, to prevent

the moisture from the drying concrete penetrating up into the timber. (See Fig. 1.)

The fundamental rule of rot prevention is: Where infection occurs despite all precautions, the diseased pieces should be removed at once. Rot is progressive and infectious.

In examining his home the owner may find that posts and joists have their bases or ends molded into concrete. The concrete thus surrounding the timber may form a pocket which will hold enough moisture to make a base for a far-flung colony of fungi. Wherever possible the concrete should be removed sufficiently to destroy the pocket.

According to good authority, rot is impossible in the absence of moisture. To the householder this may be hard to believe, when he finds that decay has attacked apparently dry timbers in portions of his dwelling where there is no chance for the collection of moisture. His discovery may involve an outbreak of rot in an inner wall on the third floor of his house, 30 ft. from the basement floor.

Basement Windows

Basements sometimes are left unventilated to the detriment of the health of the members of the household. This may be because the sash (windows) are not easy to open, or because the hook and eye or other device that holds them up to the ceiling is difficult to reach and hard to fasten, or perhaps they cannot be reached on account of a full storage bin being in the way.

Figure 2, at *A* and *B*, illustrates two simple methods of holding up a sash. If there are open beams, cut a ⅞-in. piece of wood as shown at *A* and put a finishing nail in to strengthen the hanger at the point *AA*. Be sure to drive the nail on which the hanger is suspended a little inside of, or plumb with, the bottom edge of the sash when up; do not put it farther out. Properly placed, the hanger will always engage the sash if given a slight swing when the sash is lifted.

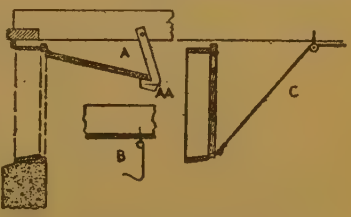


Fig. 2. Methods of holding up basement windows.

The stout wire hook *B*, hung in exactly the same way by means of a screw eye in the ceiling, is devised for a plastered ceiling where the beams are not open.

At *C*, Fig. 2, is shown a method for opening a window to a coal or other storage bin. A long cord is tied to a screw eye in the center of the bottom rail of the sash; the cord is then passed over a small

pulley screwed in the ceiling and carried to the entrance of the bin. Make one or more loops in the cord so that they may be hooked on a nail at a suitable height to hold the window either wide open or partly open. Before the bin is filled, the sash should be made to work easily. A readily movable wooden button of large size will keep the window shut. Keep a long rod at the side of the bin for turning the button.

A Preserve Closet

The simplest method of making a preserve closet for the basement, such as shown in Fig. 3 at *A*, is first to square the required number of shelves and cut them all the same length. These may be of inexpensive wood, ¾ or ⅞ in. thick and 8 or 9 in. wide. The top and sides should be at least 1 in. wider than the shelves.

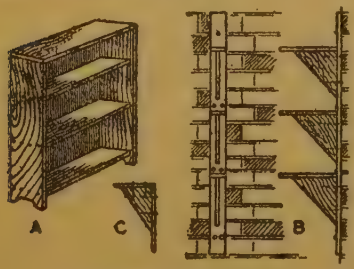


Fig. 3. A preserve closet and open shelving for basement.

Mark the two sides in the spaces desired, keeping the bottom shelf at least 3 or 4 in. from the floor. Usually the bottom or first space would be 10 in., the next 9 in., decreasing to 6 in. for the top shelf space. Nail through the ends with eightpenny common nails. Keep all shelves flush with the back.

Make the top the same width as the sides; that is, about 1 in. wider and 3 in. longer than the shelves to allow a little projection at each end. Lay the case on the floor with the back up. With a rod measure to see that both diagonal angles, from corner to corner, are alike, showing that it is square. Nail on a tongue-and-groove back —½ in. thick will do—or, if no back is to go on, two light braces nailed on the rear to keep the case square.

If the case is more than 4 ft. wide, bearers, or divisions, should be nailed in between the shelves.

When doors are desired, these may be nailed together like a screen frame and covered with screen wire (see Chapter X). This closet allows of hanging the doors in the usual way; common steel butt hinges will be satisfactory, and a spring cupboard catch, or lock, will be needed, with a hook and eye put on the inside to hold one door in place. Other designs and suggestions will be found farther on in this chapter.

A strong form of construction for a series of brackets to hold shelves is shown in Fig. 3 at *B*,

and a single bracket at *C*. This method allows ample space for nails on hard-faced walls or in any joints that may be found, or in wooden plugs driven into drilled holes in the wall.

The strength of these brackets depends on cutting the diagonal pieces the right way; note the way the grain runs in the illustration. To cut them in this way, lay your steel square flat on the board with, for example, 7 in. on one blade and 9 in. on the other, both marks touching the edge of the board; this will give the correct cuts to have the grain come the right way. This method is illustrated in the section on repairing porch steps, Chapter I.

The wall strips are 2½ in. wide (although 2 in. would do), spaced to suit, and nailed from the back with common eightpenny nails into the brackets as shown. An easy way to do this is to hold each bracket piece in the bench vise while nailing.

A single bracket is made as shown at *C;* it has an additional piece at the top to give it yet greater strength. See Fig. 18 in this chapter for other examples.

Basement Stairs

Basement steps often cause nervousness, if nothing worse. Thanks to the modern electric switch at the top of the stairs, there are not as many accidents as there once were, but serious falls are frequently caused because of haste, carelessness, or inferior workmanship in building the stairs.

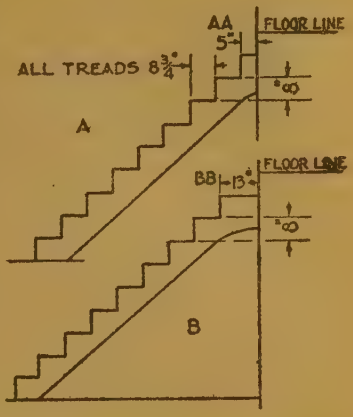


Fig. 4. Diagrams illustrating common defects in basement stairs.

A condition sometimes exists as in Fig. 4 at *A*. Every step is right except the top one, *AA*, which is 5 instead of 8¾ in. wide. One never becomes thoroughly accustomed to an irregularity like this, which is always dangerous. A low or narrow step, if anywhere, should be at the bottom.

To remedy a condition of this kind, enlist the aid of a strong helper and pry down the flight, which usually is not difficult to do in the basement. Cut off or add material as necessary. Then replace the stairs and secure the top step with metal hangers, if needed. The stair will be safer.

At *B*, Fig. 3, every step and riser is quite normal except that the top step is 13 in. instead of 8¾ in. in width. No doubt the maker of these stairs had in mind a real platform at the top, but finding he did not have sufficient headroom at the bottom, he cut down the proposed platform, with the result that there was neither a platform nor a good step. Stepping out from the kitchen door on to this wide step, one has either to take a short step or make a shuffle before taking the second step, which is unusual and unpleasant. The remedy is to pry down the steps and cut off the extra 4 in. of width at the top, or so that the step will, at least, not be more than 1 in. wider than the others. If there is plenty of headroom below, the steps may be pushed back and a real platform built, if desired, but it should not be less than 2 ft. wide.

Sometimes, because of lack of space, there is a high rise, or high step, instead of the usual 8, 8¾, or 9 in. Frequently the same width of step is used as for an 8-in. rise. This is a mistake; it should be at least 1 in. less in width. Without discussing the recognized rules for proportioning stairs, it is sufficient to say that with a high step, a narrow tread should be used, and with a low step, a wide tread.

The standard size step or "stepping" sold everywhere is 1¼ by 10 in. wide—in reality 9⅞ or 9¾ in. Both *A* and *B* in Fig. 4 are cut to suit this tread or step. The nosing or overhang accounts for the difference in the width. Thus an 8-in. cut on the strings (sidepieces) for height is about right for an 8¾-in. cut for the steps. With a high rise of 8¾ or 9 in., the cut for the step should not be more than 8 in. which, including the nosing, makes a 9-in. step.

If there is plenty of space and the cost of a step or two more is of no account, a very comfortable step might be cut 10½ in. on the tread and 6¾ in. on the rise or height. This makes use of another regular size stepping, which is called 12 in. but is actually 11¾ in. This may be obtained in many mills.

From the foregoing hints it may be seen that many other inequalities, often making for discomfort in basement stairs, may be remedied.

How to Silence Creaking Stairs

Perhaps nothing is more annoying in a home than creaking stairs, especially at night or in sickness. The unseasoned wood of which the stairs were built is the prime cause. After a season or two it dries and shrinks; steps become loose, and risers also. To make a really good repair, the lath and plaster underneath the stairs should be taken down so as to get at the stair from underneath. This is an unpleasant and expensive job and not to be

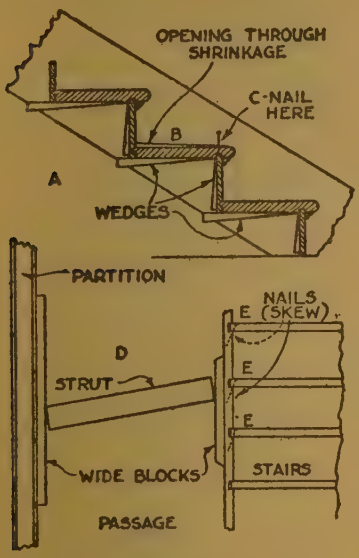


FIG. 5. How to wedge up and nail loose, creaking stairs.

lightly undertaken, yet there are now manufactured so many excellent wall boards that the task of replacing the plaster with one of them is comparatively simple.

If the plaster is removed, the wedges shown in the stringer at *A*, Fig. 5, must be glued up and tightened. Glued blocking must be put in at the angle of the tread and riser. The riser must be renailed from behind into the back edge of the step, and the step nailed from the top to the riser. This, well done, will make them silent.

However, if it is proposed to attempt the repair from the top side alone, set a wide board against the ball partition to preserve the plaster, then place a short block on the stringer of the stairs, and force in a tight strut as shown at *D*, Fig. 5. Nail eightpenny finishing nails at a very slight angle in both step and riser as at *E*. Do only three steps at a time before changing the strut to a new position. Nail in the same manner at the wall side, continuing until all steps are done, and then nail the landing nosings.

If openings are found above the steps at both sides, as shown at the wall side at *B*, make long wedge-shaped slivers ½ in. wide and glue them in. After the glue is dry, trim them with a wide sharp chisel. Drive two finishing nails through each step into the risers as shown at *C*.

The illustration shows a closed stringer; for an open stringer the nails should be driven in straight at the outside, of course, but at an angle at the wall side.

VENEERING STAIRS

In Fig. 6 is shown the modern method of repairing old and worn stairs in the same manner as old floors. Cut off the nosing of the old steps at *A* after removing the molding, or scotia. The molding will be replaced later. Before laying the ½-in. floor and rabbeted nosing, pack up the steps in the hollow spots with builders' or carpet felt, building paper, or even cardboard. This is essential in the case of a

thin floor anywhere, or creaking will result in time.

The riser is shown in one piece, although the same tongue-and-groove flooring might be used. The

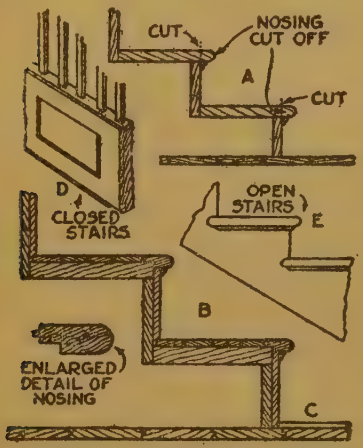


Fig. 6. Steps in overlaying worn stairs with ½ in. thick wood.

nosing must be made as shown in Fig. 6 at *B*. It may be left without a tongue if not convenient to make, but it must "set" firmly in place and be nailed securely to give lasting satisfaction. The main floor is shown veneered in the same way, at *C*.

The illustration shows the work done in a closed stair (see Fig. 6, *D*). An open stair, as at *E*, is a little more complicated on account of the returned ends, but with ingenuity and care the home mechanic may achieve a workmanlike job. Other suggestions about stairs were given in the section on basement stairs.

Newels and Balusters

To tighten loose newel posts and handrails, it is first necessary to brace them thoroughly. From the angle of the base and floor at both sides, secure strips of wood against the newel to hold it firmly; or struts from the walls may be used as shown in Fig. 5 at *D*. With eightpenny finishing nails, soaped at the points, nail the underside of the handrail at the starting newel or the upper side at the landing newel, as necessary; also drive nails at riser, tread, and stringer. Drive all these nails at an angle (skew) and set them with a nail set before removing the braces.

In a closed stair the balusters are nailed in the same way. In an open stair the return nosing may be pried off and the tenon in the step wedged up tight.

The Care of Doors

We speak of the "care of doors," more than of repair, because in general it is a matter of the adjustment of hinges or lock plates, or the taking off of a few shavings at exactly the right place, all done so as not to spoil the appearance of the door.

Generally a well-hung door in a

well-built, well-seasoned house will cause little trouble, but during the summer humidity and winter furnace heat, the best of them are likely to forget their manners.

What is the first step in easing a door? Investigate and locate the trouble. If the annoyance begins soon after the artificial heat of winter has been dispensed with or in the dampness of early summer, it will grow worse as the moisture has its effect, hence the door will demand more drastic treatment. As each defect is a problem by itself we will treat each separately, although each may appear on any door.

When Doors Stick

If the top of the door does not stick too badly, it may be eased by using a plane. Hold the door by a wedge at the bottom as at *A*, Fig. 7. In doing this plane a light shaving from each side of the top corner of the stile to prevent splintering the wood. Carry the plane straight on the top of the door, not at an angle, which would probably tear ugly splinters from the sides of the stile.

If more than a few shavings are to be taken off it will be better to take off the door. If the door is hung with loose joint butts as at *B*, Fig. 7., it may be opened and lifted off its hinges easily. If hung with loose pin butts, the pin may be lifted out with a screw driver or nail set and hammer if the fingers cannot start it. Remove the pin from the bottom butt first, so the top butt may hold the door.

If the bottom end of the lock stile strikes the threshold, the door may be removed and planed. Another method is to note the space between the front edge of the door and the jamb; if it is not less than 1/16 in., the sticking may be reduced and perhaps cured by manipulating the hinges. Back the screws of the

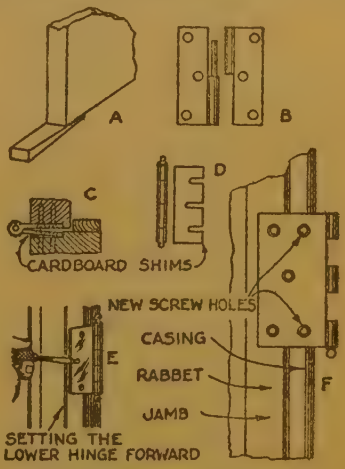


Fig. 7. Methods of adjusting and refastening door hinges.

bottom hinge out a little and insert a piece of pasteboard under one or both butt flaps as at *C*, or better, full width, as at *D*, Fig. 7, as may be required.

When a floor is uneven and a door drags on it, usually the front

stile may be lifted above the floor by setting the lower hinge out a little as will be noted at *E*, Fig. 7, or a wider hinge may be used, in which case the hinge will fill entirely the recess made for the original butt. If the door has three hinges, the middle hinge should be set out so the three pins will be as nearly in line as possible, although at best there will be some strain on the hinges. The spaces made by moving the original butt out will be seen only when the door is open, but they should be filled with a carefully fitted piece of wood and finished to match the adjoining wood. However, if there is no reasonable objection, a door may be made to pass over an uneven floor readily by fitting a threshold (saddle) ½ or ⅝ in. thick. Before taking the door down to make this addition, set the compasses a trifle wider than the thickness of the threshold and mark (scribe) both sides of the door at the bottom; then cut the door off to the line.

Loose Screws

If the screws of the top hinge have pulled out of either the door or the jamb, longer screws may be used or the old screw holes may be filled with a glued-in plug and the screws turned in again. Sometimes the top hinge of a heavy door may be made to hold only by driving long slender screws through the jamb and into the studding. If, as is often the case, a plug does not give promise of holding and the screws only reach back into lath and plaster, as with many doors having narrow butt hinges, then the hinges themselves may be drilled and countersunk in line with the center of the door casing and a new and firm hold may be obtained. Drill bits and a countersink for metal should be included in the tool kits of all home mechanics. Hinges usually are of soft metal and yield readily to a good drill bit. See Fig. 7 at *F*.

Hinge-Bound Doors

A hinge-bound door may be the result of repeated coats of paint and varnish. Inspect the screws of hinges carefully to be sure they are driven home. If the door still gives trouble and the width of the crack along the lock edge will permit it, loosen the screws in the jamb and insert a piece of pasteboard as at *D*, Fig. 7. If this does not relieve the annoyance, proceed as follows:

Close the door and insert a piece of stiff paper in the joint (see Fig. 8, *A*) as deep as the thickness of the door and slide it back and forth gently. The places where the door binds may thus be located, for the paper will move easily until it reaches the point of contact between the door and the jamb. Do this the entire length of the joint,

noting carefully the places where the paper does not pass.

Take the door off and remove the hinges. If available, a rough plane should be used to cut through the paint, for it will dull any edge quickly; or a scraper may be used. See Fig. 8 at *B* for a method of holding the door.

Plane the entire edge to prevent a possible repetition of the annoyance but do not disturb the face corner, for this will be seen when the door is in its place. Note the amount of wood thus removed in shavings, and with a sharp chisel cut the recesses of the door to receive the butt plates that much deeper. Reset the butt plates and rehang the door.

Binding at the Lock Edge

Note the amount of wood which prevents the door from closing and compare it with the hinge joint of the door. A good craftsman seldom planes the front edge of a door because it involves removing the lock, setting it deeper, and changing the latch and bolt openings and face trimmings. Both of these processes will leave conspicuous evidence which will be impossible to remove.

To avoid the resulting defacement of the door, take it from its hinges and apply the method shown in Fig. 8 at *B*. The stile should be planed the entire length and fitted carefully to the jamb, planing only enough to allow the door to enter the jamb with a close fit, for with modern artificial heat, which is excessively dry, the door may shrink too much. Sink the hinges a distance equal to the wood planed away. Be sure the back edge is planed a little under to avoid hinge binding.

Lock Strike Plates

Often the latch will not catch in the strike plate, and the door cannot be latched and will not stay closed. If pasteboard under the

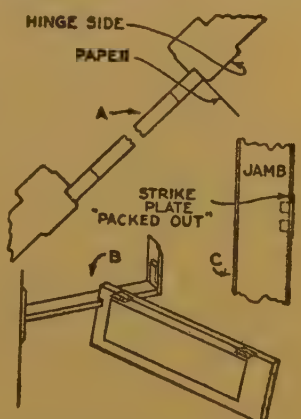


Fig. 8. How to test and plane a sticking door; packing out a strike plate when a door will not catch.

hinges as at *C* and *D* of Fig. 7 will not push the door over enough to make the latch engage the strike plate, the latter may be built out to receive the latch by fitting behind it a piece of heavy pasteboard

or of wood as at *C*, Fig. 8. Drive longer screws into the jamb to hold the strike plate in place.

If the latch or bolt does not enter the strike plate, the plate may be taken off and the openings filed on either the top or bottom, or the plate may be reset enough higher or lower to allow the latch and bolt of the lock to enter the openings.

Warped and "Winding" Doors

Doors out of true are not readily restored to a normal condition. A common batten door (see Fig. 9, *A*)—that is, a door made up of a number of pieces secured with two battens screwed or nailed on, often with a cross brace added to prevent sagging—may be brought back into shape by taking off one of the battens, testing it to see if it lies quite flat, and if not, rejecting it and replacing with a new one. If this is not enough, the other batten and perhaps the cross brace, too, must be treated in the same way. In doors of this kind the battens, at least, should always be sound and of material which does not warp readily.

With paneled doors, one method is as follows: With a back saw or a tenon saw make a cut at the top joint shown at *C*, Fig. 9; do this also on the reverse side and at the opposite bottom corner. Do not cut in more than one third of the thickness of the door. Make two beveled, wedge-shaped pieces of close-grained hardwood. Hold the door true on benches with hand screws, or by other means; glue and drive the wedge-shaped pieces in, and let the door so remain until the glue is

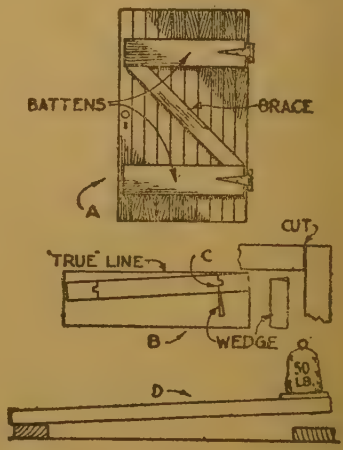


Fig. 9. An ordinary batten door and two methods of straightening a warped panel door.

dry; then clean off with a finely set smooth plane. The edges of the wedges should be touched up to match the finish.

When a door of inferior wood is hung where it is subject to dry heat on one side and to cool moist air on the other, as from a kitchen to a passage, it is likely to become "in wind", as it is called. Take down the door, lay it on two flat pieces of wood on the floor in a spare room with the driest side down, put a heavy weight where it may be re-

quired to bend the door straight again (see Fig. 9 at *D*) or even a little more in the opposite direction, and let it remain for a few days. Then give it a coat of paint or varnish all over, including the top and bottom edges.

At a carpenter's shop the method probably would be to make several cross cuts in the crooked stile and split it off, exposing the tenons or dowels. A new stile would be fitted, glued, and clamped. This involves refinishing the entire door.

Cutting an Extra Doorway

When the general position of the proposed opening has been chosen, tap the wall with a hammer to find out by the sound just where the studs are located. Studs are the upright pieces to which the laths are nailed, and they are usually 16 in. from center to center. If it is at all possible, one side should be marked out quite near a stud; the other side will, of course, have to be cut according to the width of the door, as at *A*, Fig. 10.

Having plumbed down the first line, measure across 3 in. more than the width of the door, and measure up 3½ in. more than the height of the door, and draw lines carefully on the wall. For example, if the door is to be 2 ft. 6 in. by 6 ft. 6 in., the opening should be 2 ft. 9 in. by 6 ft. 9½ in.

Cut the plaster to the lines with a chisel and hammer, breaking out only an inch or so. Then, with a coarse compass saw, cut through the laths, so that you can tear down both lath and plaster. Mark guide lines on the other side of the wall exactly opposite and cut out in the same manner.

A narrow compass saw is better for cutting the lath than a hand saw, as it does not bind so much.

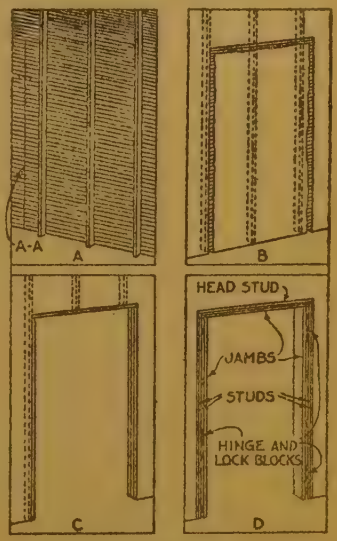


Fig. 10. Steps in cutting, framing, and trimming a new doorway.

Some cut through the plaster as well as the lath with a saw, but it is not considered good practice, as the edge is at once taken off the saw. In fact, it is much harder work and no quicker. It takes only a few

minutes to chip out the plaster sufficiently to expose the lath, as shown at *B*.

It is comparatively easy to cut near the stud, but on the other side, where the laths may project as much as 7 in. (see *AA*, Fig. 10), care must be taken or the edge will be jagged. One way to prevent this is to attach a board about 7 ft. long close to the line with fine nails and cut down close to the edge of the board, so that the plaster will not be broken out where it might show.

The next step is to cut out the studs with a hand saw. Then cut a piece of 2 by 4 in. and push it up in place to form the head. Cut two studs the right height for one side and one for the other, as indicated at *C*, or, if the laths are cut close to the stud, none will be required on one side. The opening now should measure 2 ft. 9 by 6 ft. 7½ in. Nail the head and sides squarely and tack to the studs any loose laths along the sides.

The opening is now ready to receive the jambs. Set the jambs plumb with great care, as otherwise the door may develop an annoying habit of closing by itself. See that the head is level or the job will look badly. The extra space allowed between the jambs and studs is to allow blocking to be used in plumbing the frame, as well as space for the hinge and lock blocks, which should always be inserted opposite hinges and lock, as at *D*.

If the base pieces adjacent to the doorway are short, it is easiest to remove them and fit them back again after the casing is on. Otherwise, mark exactly where the casing comes on the face of the base, drive it out from the wall, putting a block behind it to hold it out, and cut down on the line with the point of the saw.

Generally speaking, it is cheapest, if a woodworking mill is near by, to buy the jambs, door stops, threshold, and trim complete to suit the size of the door. Sometimes old-fashioned trim has to be matched, in which event it must be made by hand, and then the home worker can profitably do the work himself. Remember always that it is not necessary to make moldings and trim in one piece. Several odd pieces of molding will often work together to match old-fashioned trim.

Fitting and Hanging a Door

If the door to be hung is for a closet or other place where only one side is subject to scrutiny, the best side should be placed outward if possible; but, in general, it is best to sight along one side to note if there is any "spring" in the stiles (long side pieces), and if there is, place the concave side against the stops.

Lay the door on a pair of saw horses and cut off the projecting ends of the stiles. If the latter are

of fir, the splintering of the underside hardly can be avoided unless the saw is to run nearly horizontal and the final cutting off is done from the underside. This necessitates more care and extra handling of the door, but the resultant smooth surface is worth while.

Hold the door for planing by the method shown at *B*, Fig. 8, or build a jack as illustrated in Fig. 10. The jack is made by nailing two short

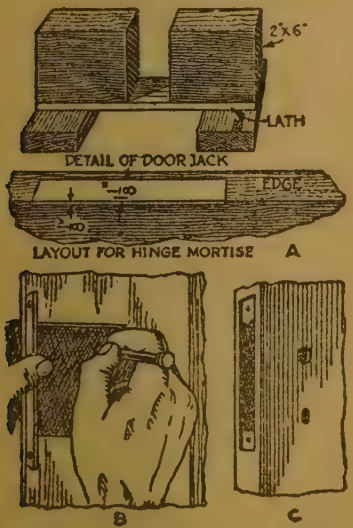


FIG. 11. A holder for planing doors; how to lay out hinge and lock mortises.

lengths of 2 by 6 in. stock to a piece of lath, keeping them apart a trifle more than the thickness of the door. Under the ends of the thin strip nail blocks for feet.

Mark the lock stile and set the door edgewise with one end of the hinge stile in the jack. Plane the lock stile straight with a jointer or the longest plane you have and bevel the edge slightly toward the stop side. If, however, the lock jamb is crooked, which is the case only too often, make suitable allowances.

Now stand the door in the opening, with the lock stile against its stop, and hold the other stile against the jamb edge. Slip a wide chisel underneath for a lever and use a block as a fulcrum. Force the top of the door against the upper jamb and have some one run a pencil down the hinge stile with the jamb as a guide. Lay the door on the horses again and rip off the excess width if it is as much as ¼ in. Plane to the line, beveling a little toward the stop side.

Stand the door against the stops, and with scribers or compasses scribe the top rail to the head jamb. Saw and plane to the line, guarding against splintering the stile ends.

The fitted door should have a clearance of a trifle more than 1/16 in. all around if the trim is to be painted in the ordinary way, or a little more for a paint job of more than four coats.

Pry the door up to the top, keeping the necessary clearance by inserting a chip or a hand scraper as a gage. Measure from the floor and the upper jamb the distance to the

hinges (usually 11 and 7 in. respectively) and with a knife point pressed between door and jamb mark the positions for the hinges on both of them.

Support the door in the jack. Take the pins out of the hinges and set a gage for 1⅛ in. Score a light line (Fig. 11) the length of each hinge, top and bottom, afterward squaring across for the ends. Take the door-half of the hinge, lay it upside down on the stile edge with one end at an end line, and scratch the other end. Lastly, gage for the depth of the hinge mortise—the hinge thickness, or about ⅛ in.

Now, with a wide (or butt) chisel and mallet (you can use the side of your hammer head if you have no mallet), score deep cuts the full width of the mortise. Be careful to avoid cutting too deeply. Start near the center and work toward the ends, or cut out a section near each end, remembering that the chisel crushes the wood back for a short distance. In this way the depression can be trimmed exactly to the line.

Undercut the mortise a trifle, since most hinges are beveled and can be slipped in from the side, dovetail fashion. In trimming out the chips, hold the chisel horizontally, left hand on the blade, right on the handle, with the fingers of the left hand acting as a gage to prevent splitting off the wood at the far side, beyond the hinge. If the latter happens, glue the splinter in place by laying over it a piece of paper and a block. This block can be tacked down temporarily with brads to hold it firm.

The hinges fitted, slip the halves into place and drill screw holes. Apply wax or soap on the screws, drive them in a short distance with the hammer, and sink them home with a screw driver.

To mortise for the jamb halves, gage as for the door, except that the width should be 1/16 in. less, to allow for clearance for the stop. If a butt gage—a special tool—is used, the stop may be used as a guide, provided it is already in place, as the gage automatically allows for clearance.

If, when hinged, the door strikes on the lock stile, set the hinges a little deeper, or shim the inside edges with cardboard, which will make them draw the door close to the jamb.

Cut off the bottom to give a clearance of ½ in., so that the door will open over carpet or rugs, and sand the edges smooth, rounding the corners very slightly.

In the final fitting, work with fine shavings, remembering that it is much easier to take off stock than to add it.

How to Fit Door Locks

To fit the average inside door lock, open the door halfway and drive a wedge under the bottom to

hold it steady. Three feet up from the finished floor draw a light pencil line across one side of the stile. Now hold the lock against the stile so that the spindle hole is on the line and the front plate is flush with the stile edge. Mark the position of the keyhole and knob with an awl as at *B*, Fig. 11. Slip the front flange over the door edge in order to locate the ends of the mortise for the lock. To understand these operations, you will have to take the lock in hand and follow the process step by step; it is simpler than it sounds to be.

If the escutcheon plates act as key plates and knob roses, bore keyhole and knob spindle hole with a ¾-in. bit, cutting in from one side until the spur pricks through the opposite, and finishing from that side. If individual roses and key escutcheons are used, bore the spindle hole with a ½-in. bit and the keyhole with a ⅜-in. bit, cutting out the straight lower part of the latter with a ¼-in. chisel.

Gage a center line for the mortise, and with a ¾-in. bit bore five holes centering on the line. The end holes also are centered on the end lines. Use a wide chisel to trim out the mortise until the lock slips in freely. Insert the lock, slip in the spindle, and put in the front plate screws. Then use the plate as a template for marking the boundary of what is to be its own shallow mortise. Remove the lock and chisel out the wood until the plate will fit in flush (*C*, Fig. 11). Screw the lock in and put on the escutcheons or the knob spindle roses and keyhole plates.

Close the door until the bolts touch the jambs and mark top and bottom of each with a pencil. Open the door, gage a pencil line as far back from the edge of the jamb as the inside edge of the lock front, and screw the keeper in place, observing the bolt marks on the jamb. Trace around with a knife, remove and dap in flush. Bore out the mortises for the bolts last of all.

This method varies somewhat from the usual practice of carpenters, but the home mechanic will find it well adapted to his particular needs.

Before painting or varnishing, remove the lock and keeper.

In many cases the lock, as it comes from the hardware store, has the beveled face of the catch bolt facing the wrong way. Lay the lock on a bench and take out the plate screws. Lift the side plate off carefully to avoid loosening the parts, then take out the latch bolt, turn it over, and replace the cover.

How to Open a Lower Sash That Sticks

Find out why it sticks, if possible. Is it held by a film of paint or varnish, does it appear to have been fitted too closely, has the wood swollen badly, or may the fault be

laid to all three causes combined?

If paint is the cause, tap the sash, the stop strips, and the stool cap (often called the inside sill) lightly to break the film. Use a piece of wood to prevent hammer marks. Push or strike lightly with the hand under the top, or meeting, rail. This should start the sash. Perhaps rapping sharply downward on the end of each stile or sidepiece may break the paint film of that joint.

In case of the second or third cause, or both of them, pry the sash up by using a wide, thin chisel between the sash and the stool. Do the prying from the outside if the window can be reached conveniently, so that the bruises will not be seen from the inside.

If the sash does not start, drive the chisel very carefully between the stool cap and the lower rail of the sash in the middle so as to spring the lower rail and break the film of paint. A light tap on the sash may break the film of paint, but it may also break the glass or the putty.

If the sash still sticks, drive the chisel into each jamb or pulley stile just above the sash and closely against the back edge of the stop strip. Pry gently on the chisel against the strip, starting the screws or nails in the strip, if necessary.

Try prying gently at the lower end of each stile instead of the middle of the rail, but avoid using the chisel thus if possible, as it will bruise the wood.

If the sash is swollen, remove the stop strips at each side (see the following topic on how to remove sash) and plane a few shavings the entire length of the back edge of each. Take more off above the lower sash to allow the sash to slide upward easily once it has started. Also ease the outer edge of the stool with a bullnose or rabbet plane and chisel if the sash sticks at this point, as it often does. Touch the edge with paint afterwards, for it is exposed to the weather when the lower sash is open.

If the weight cords are pulled down as far as possible and allowed to snap back simultaneously, the jar may start the sash.

Loosening an Upper Sash

Gentle tapping upon the meeting rail may start the upper sash, but as the rail and stile joints are easily broken, it should be avoided if possible.

Pry down powerfully on the outside of the window at the top, over the ends of the stiles (sidepieces). Use the chisel more gently to pry between sash and blind stops (the outside stops) on both sides.

In stubborn cases, remove the lower sash (see the following topic) and use a broad chisel to spring the parting strip as far as possible from the dado or groove in which it is

fitted. This strip separates the upper and lower sash while they are sliding and makes the vertical joint as nearly weatherproof as possible.

How to Remove Lower Sash

Remove the left stop strip *A*, Fig. 12, by preference, as this will allow right-hand work. If the cord on the right side is to be repaired, however, the strip on the right side (A^1) should be removed. Back out the screws and tap the strip lightly on the face or on the sash edge, not on the front edge, if the strip does not spring off when the screws are removed. Do the tapping on a small piece of wood to prevent hammer marks on the varnish or paint finish. Drawing a knife blade along the joint between the strip and the casing *B* will cut the surface film of the finish, if the tapping is not sufficient.

If the strip is nailed on instead of fastened with screws, begin at the middle with a wide chisel and pry it carefully away from the casing. Because of the hardened putty or filler in the nail holes, it is best to pry the strip right off and either pull the nails out through the back or cut them off. Any attempt to draw the nails through the face is almost certain to mar the finish. Spring the strip out from the center, which will shorten it, and release the ends from the stool and the header to prevent scratching the finish of the stool cap *C* and the head stop strip.

Lift the sash above the stool cap and draw the edge of the sash into the room enough to allow the sash cord to be removed. Usually the cord will be fastened to the sash as at *D*. Pull the cord down to give a little slack, remove the knot from the hole, and untie the knot or cut it off if the cord is long enough and is to be used again. Tie a slip knot as at *E*, and with a finger through the loop, allow the weight to pull the knot up the pulley.

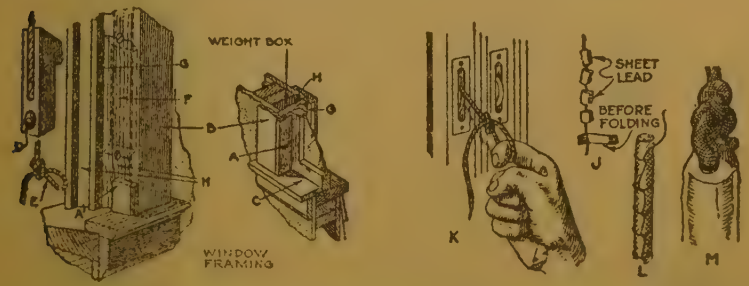


Fig. 12. Typical construction of a double-hung or sliding sash (at left). How to knot a sash cord and make a so-called "mouse" (at right).

Remove the cord from the other side by the same method. The stop strip has to be removed from that side only if the weight there must be rehung. Then it has to be removed to allow access to the pocket in the pulley stile which usually is fitted as at *F*, so that it can be taken out to reach the weight.

Removing Upper Sash

Remove the lower sash as just described. Lower the sash until it rests on the sill or as far as the cords will permit. Remove the parting strip *G*, Fig. 12, from the groove in the pulley stile or jamb *H*. If the strip is held by paint or varnish, loosen it by the method described at the beginning of the instructions for removing lower sash. Usually the left strip will be more conveniently handled. If necessary to pry it out, use a thin-edged chisel and pry carefully where the chisel marks will not be seen on the inside. Work from the part of the strip which you find you can loosen most easily.

Remove the cords as described for a lower sash.

How to Replace a Sash Cord

Inspect the cords of both upper and lower sash; if one is broken and one or more are worn and frayed, it will be an obvious economy to replace them at the same time.

Obtain a good grade of braided sash cord from the hardware store. It will be more economical to buy an entire hank if several cords are to be replaced, but if only one or two, the quantity needed can be figured roughly by allowing 5 ft. for each cord of any window of ordinary size.

We will assume that only one cord is to be replaced and that in the lower sash, for that is more likely to give trouble. Remove the sash by the method described in the sections on removing upper and lower sash and illustrated in Fig. 12. If there is a broken cord on each side, remove both stop strips, but if only on one side, the other side need not be disturbed.

If but one cord is broken, swing that side of the sash out and place a kitchen chair or a box under it. It is, however, perfectly good practice (although skilled craftsmen avoid it if possible) to take the good cord out of the sash, tie a knot in it, and allow it to run to the pulley.

Remove the pocket facing; it may be necessary to take out the parting strip to do this. Lift the weight out of the pocket, cut the rope away from it, and dig out the knotted end from the sash (*D*, Fig. 12). Observe how each of these knots is tied and fastened.

The easiest way to put the new cord through the pulley is to make a "mouse." Wrap several narrow

pieces of thin sheet lead around a piece of strong, flexible line perhaps 8 ft. long, as at *J*. Pound lightly, or press each piece of lead so it stays in place about as shown. A piece of chain, a bent nail, or other light weight will answer the purpose as a makeshift. A 4-in. length of sash chain makes a particularly convenient "mouse."

Tie a knot near one end of the cord as at *K*. If a hank of cord is used do not cut at this stage, but after the weight is attached as described in the next paragraph; then tie the long end of the mouse line to the other end, using half hitches as at *L*. Push the mouse through the pulley from the front; allow it to drop down the pocket behind the pulley stile until it can be reached from the pocket opening. Pull out the mouse through the opening and at the same time coax the cord through the pulley from the front. Pull the cord down until the knot stops it as at *K*. Remove the mouse line and tie the end of the cord to the weight with a knot that will not slip. Use the knot shown at *M*, for example, or use the same knot that was on the old cord. Nearly every workman has a pet knot for this purpose, but any knot that does not allow the cord to pull directly over the axis of the weight will permit the latter to turn and swing in the pocket as it travels up or down, and perhaps make trouble with the other weight. The weights of the lower sash should swing clear of the back side of the pulley or the sash cannot be closed, though the stretch of the cord will soon make it right if not more than ½ in. has to be gained.

To find the length of the cord, pull the weight up until it strikes the back of the pulley. Untie the slip knot (*K*) and swing the sash back again until it is as nearly as possible in place. Hold the cord against the edge of the sash and cut it off 6 in. below the hole at *D*. Lay the cord in the groove, tie the knot, and push it into its hole. Drive a small nail through the knot, if necessary, to hold it there and push the sash into its place. Raise the sash, put the pocket face in its place, and refasten the stop strips.

The Cords of Upper Sash

It is obvious that if the upper sash is to have new cords they must be put in before those of the lower sash. In this case, remove the lower sash entirely and do not merely swing it around. Pull the upper sash down, take out one or both parting strips, pocket facings, and weights as may be required.

Put the cords in by the methods already described, being sure the cord of the upper sash is not too long or the sash may not stay up. The lower end of the weight should swing at least 3 in. above the window stool when the upper sash is in

place—to allow for the stretching of the cords. Replace parting strips, pocket facings, and stops.

The foregoing directions suppose that the window pulleys are of a height readily reached by the average man, as with most modern windows; if higher, the loop of the cord holding the weight may be held within easy reach by a nail driven in the section covered by the parting strips.

When Windows Leak

Water often leaks in and leaves unsightly discolorations on the walls of a room. One cause is likely to be a crack between the window sill

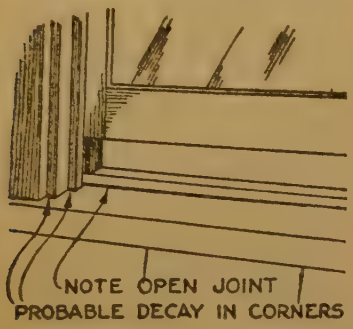


Fig. 13. Where cracks outside a window may cause leakage and discoloration.

and the inside stool, which is a molded wood strip resting on the sill (Fig. 13). To remedy this, scrape out all dirt in the crack and nail down securely with finishing nails. Scrape out all small cracks and openings in the corners of the sill where it meets the sidepieces, and stop up every opening with white lead putty or plastic roofing cement.

If the condition is very bad, and it does not seem that the small openings, already spoken of, could have caused it, then the sill must be prodded with a sharp-pointed tool to see if any parts have rotted beneath the paint, as is often the case; if so, a new sill must be put in. The leak may, however, come from a defective drip cap at the top of the window outside. All these repairs are treated in Chapter I.

Cutting Glass for a Broken Window Pane

The first problem is to get out the old glass. This is sometimes not an easy task. Where it is at all possible, it is better to take the window out of the opening so that it may be placed on a table while the work is being done.

To remove the old putty, use a chisel about 1 in. wide. Incidentally, a chisel of this size is a good one to keep on hand for general work. Care must be exercised not to allow the chisel to cut into the wood. If the putty is set very tight, there is danger that pieces of wood will come off with the putty. If the wood is cut raggedly along the edges, the appearance will be bad when new putty is applied. Take off the putty piece by piece, and

remove the "glaziers' points" (small triangular pieces of metal that hold in the glass) as they are encountered.

Clean out the rabbet or recess for the glass after the old glass has

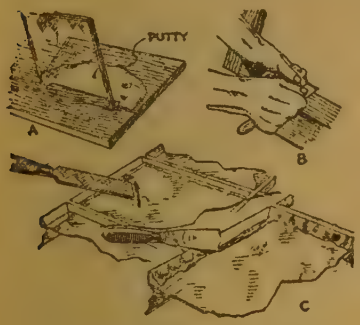


FIG. 14. How window glass is held in the sash with glaziers' points and putty.

been taken out. This operation is important, for if there are ever so small particles of putty left, they may cause the glass to break when it is put in place.

Next comes the cutting of the glass. If careful measurements have been taken, it is possible to have the glass cut to size by the dealer who sells it. If ordered in this way, it will very often need additional trimming before it will fit properly. It is well to make a habit of storing old glass in a protected place. When repair work is to be done there may be an old piece on hand that can be used for cutting a small panel.

For all the smaller panes, the glass can be cut right over the frame. Place it in position and run the glass cutter directly over the edge. This is often done without a straightedge by the experienced mechanic, but it is best for the amateur to lay a yardstick along the edge as a guide for the cutter. Care must be taken not to press too hard on the cutter.

To break the glass apart after the cut is made, the handle of the cutter may be laid directly under the cut at the edge of the glass and downward pressure applied on the waste strip. Another good method is to tap directly under the cut until the glass begins to crack and then break the piece apart with the hands.

Glass must fit loosely in the frame. If it is set tight it may break in time, even if it does not do so at once, because of temperature changes and jars and shocks. So, if it crowds in the opening, it is better to make a cut and remove a narrow strip of glass. Do not make the mistake of trying to cut away the wood instead of the glass. It ruins the looks of the job.

PUTTYING GLASS

Figure 14 shows how the glass is fastened with glaziers' points. Do not lift the chisel from the glass; simply slide it back and forth. If

you lift it once, you will probably have another piece of glass to buy. Points should be placed not more than 6 in. apart. Do not press down too much on the glass. The seat for the glass is, at the best, somewhat uneven after the glass has once been removed. It is better to leave some openings on the opposite side, unless you go to the pains of "bedding it in." This means running a small strip or bed of putty all around the rabbet before the glass is put in place, the surplus squeezed out on the other side being removed with the putty knife after the glazing is otherwise complete. One good way to bed the glass is to scrape off a little putty on each edge of the glass as shown at *A*, Fig. 14.

A neat job of puttying can be done after a trial or two if speed is not essential, although considerable practice is required before one becomes really expert. How the expert applies putty is shown at *B*, Fig. 14. The putty—which must be soft and pliable and of the best obtainable grade—is fed under the putty knife as indicated. An experienced person using putty of good consistency will run a continuous joint with one stroke. One stroke forward and one going back, followed by a light stroke with the finger to take off the little scraps left by the knife, complete the job.

Amateurs often can do a better job by first pressing putty into the angle between the glass and the sash as at *C*, Fig. 14. With a putty knife, "run down" the putty, making a smooth bevel, which will fill the corner neatly. If the putty knife is moistened in soapy water, it will slip over the putty smoothly. The corner of the sash will guide the knife if it is held at the correct angle. Care must be used, however, that the glass edge of the putty does not project beyond the sash rabbet, or it will be seen through the glass from the inside. It is excellent practice to keep the putty edge a little back from edge of the sash rabbet.

If the glass has not been "bedded in," it is well, particularly on old work, to put putty on the inner side of the sash in order to fill any irregular open places left between the glass and the wood. Just a stroke with the putty knife will do this, and the sash is ready to be put back in place.

Wooden strips, called glass stops, are often used to fasten large pieces of glass and plate glass. When these are used it is seldom necessary to take the sash out of the frame for repair.

Much inferior putty is sold, which soon dries up and cracks off. A wood sash putty that will stick during the whole life of a building is made from white lead-in-oil paste and dry whiting, thinned a trifle with pure linseed oil. Such putty will seal up the glass against water and wind leakage.

When the windows are painted (after ample time has been allowed for the putty to harden), the paint should be run well over the putty. Paint on the glass is easy to remove when dry with a tool consisting of a metal handle for holding an old safety razor blade, which can be obtained at any paint store.

A broken window in which most of the glass remains, although perhaps badly cracked, can be secured temporarily by pushing a piece of putty through the hole, pressing down on both sides, and running friction tape or surgeon's plaster for a few inches along the cracks.

If a large and heavy plate of glass has been cracked, the pieces can be held in place with a small bolt (or bolts) having felt-covered washers on either side to hold it in place. The hole for the bolt may be drilled with a very hard twist drill by having some one hold a block of wood against the other side of the glass. Turpentine or kerosene will serve as a cutting fluid in the drilling operation.

How to Repair Floors

On account of the unequal "settling" of a house, wide cracks often develop at certain points in otherwise good floors. The woodworker's method of filling these is to take a narrow, keen, bevel-edge chisel, with the sides also sharpened at the point, and draw it back and forth in the opening to "clean" the edges of the flooring and the top of the flooring tongue.

A strip is then ripped off a ½- or ⅜-in. board a little wider than the crack; a slight bevel is given to the cut, but not too much. Glue the bottom and square side—not the beveled side—and drive the strip into place with the square, glued side towards the tongue edge of the floor; as all nails are driven in the tongue side, indications of which is the tongue side are easy to find. The reason the beveled side is not glued at the groove edge is because there is a constant expansion and contraction in floors. If glued in solidly, the filling piece would give way in places in the course of time.

Loose ends may be nailed down from the face with finishing nails into the joist below. After one joist has been found, the others usually may be located by measuring 16 in. either way, as regular joists are set on 16-in. centers.

If good nailing is not found at an end joint, a piece of floor must be lifted and a cleat nailed to the joist to give a fresh bearing. It is well to remember that in an old floor under which there yet remains the old style lead pipe, especially in kitchens and bathrooms, no nail should be driven where the pipe is likely to be. If uncertain, it is better to lift the floor and be sure.

Opening a Floor

To get at pipes and wires it is sometimes necessary to open up floors. To do this it is essential to have a fine-pointed compass saw, that is, a narrow-bladed, tapered saw. To make an opening for the point, a chisel must be driven down into the floor joint close to the joist at which the cut is to be made. Insert the point of the saw and work it round at a short angle so as to cut across the piece to be removed. Do the same at the other end close to another joist.

If the floor is old and shrunken, it may be possible to pry it up from the side—not the end—with a wide chisel; if not, saw along the tongue at one side and pry it from that side. Before re-laying the flooring, nail sound cleats, at least 6 in. longer than the width of the piece removed, to the side of the joist to give the ends a "bearing."

If a new piece of flooring is to be laid, and the old discarded, holes may be bored for the compass saw to enter and the ends may be cut back with a sharp chisel onto the joist, so that no cleats will be required. It will be seen that when one piece has been lifted, the opening may be readily extended to any size desired.

There is now obtainable a special hand saw, used by electricians and other mechanics, to open up floors. This is a short saw with a convex saw-tooth edge, instead of a straight edge. The rounded blade can be started into a floor without any opening for the saw point.

Preparing Floors for Linoleum

Very little preparation is required before laying linoleum on a modern tongue-and-groove floor, but with old and much worn floors, considerable work is often necessary. As these old floors were usually surface nailed, it is necessary to drive down the protruding nail heads with a large nail set. All loose boards must be nailed, too. If the nails do not hold, the board must be lifted in the manner described in the preceding section and cleats placed underneath.

All floor boards with rough or sharp edges, as well as uneven end joints, must be roughed off. The ordinary smooth plane, whether of wood or iron, is not the best tool for this work. A sharp, wide chisel will do very well for many end joints, but for others a short, iron, bull-nose plane—one of the least expensive planes to buy—will, if the mouth is set for coarse shaving, act very well. There is probably nothing better for this rough work than a narrow wood smoothing plane with a cutting blade ground slightly convex, the whole blade being rounded about ⅛ or 3/16 in. It is not necessary or desirable to round the wood bottom of the plane

like the cutter. With the iron projecting and a wide mouth for shaving clearance, this is a surprisingly effective tool for taking off rough shavings in hollow spots.

In an old floor, such as we have been considering, it is not expected or desired that it be made perfectly flat, but all sharp, rough edges must be taken off before the linoleum base is laid.

Laying Linoleum

Modern methods of laying linoleum make a perfect and lasting joint, and secure the edges firmly against moisture.

Begin by prying up with a wide chisel all the quarter-round molding or "shoe" at the angle of the base and floor. Do this carefully, as it must be replaced after the linoleum has been laid. Having prepared the floor as previously suggested, lay builders' felt or linoleum felt—to be bought in rolls—the short way of the floor, provided the linoleum is to be laid the long way of the floor, which is the usual method. Fit the felt carefully, paste it down, and roll it with an improvised roller, such as a heavy crock, if a regular roller cannot be obtained.

Before laying the linoleum, expose it to the warmth for some time; do not attempt to lay it cold and unsoftened. A thin sharp knife of good steel should be used for cutting. To make a perfect joint an expert would lap one edge over the other and cut right through both pieces, taking care that the design was unbroken in the lap. Tinner's snips are useful for cutting linoleum, as well as roll roofing, heavy building paper, screen wire, and similar heavy materials.

The linoleum is pasted like the felt everywhere except a margin of 4 or 5 in., which is left at each edge. These edges are turned up carefully and waterproof cement is spread on the felt base under all the joints. To keep the edges in place, they are either rolled or weights are put on and left for several hours. All joints and edges must be sealed carefully with the waterproof cement to make a lasting job. In buying cement, allow 1 qt. for 30 ft. of seams; allow 1 gal. linoleum paste for about 6 sq. yds. of felt and linoleum.

For a small room the simplest way is to purchase linoleum wide enough to cover without joints; it may be bought 12 ft. wide.

Heavy building paper is sometimes used as a base instead of felt; although not so good, it is far better than laying linoleum on the bare floor.

After the linoleum has been laid, the quarter-round is replaced and nailed, the nails being driven in at an angle (not into the linoleum).

Insulating a House

While the best job of insulation is done on a new building, much improvement can be made by insulating the walls, roof, and attic floor of an old house. It is unnecessary now to point out the great value of insulation—its saving in the cost of heating in the winter, and the greater comfort it affords in summer. Bear in mind that insulation is to be judged not so much by its weight or thickness as by its tested quality.

Undoubtedly the most convenient form of insulation for the handy man to use—and the type that is universally obtainable—are boards consisting of large, light, and relatively thick sheets of shredded cane, cork, and other standard, high-grade insulating materials. The application of these insulating boards requires no great skill, involves a minimum of disorder during the work, and entails no waste.

The insulating boards should be distinguished from thin fiber, plaster, and composition wall boards which are designed primarily for decorative purposes—to improve appearances and to cover cracked plaster and unsightly walls. These also are valuable in improving a home and are easy to apply, but their insulation value is of secondary importance. Much of the following discussion applies to the use of both types.

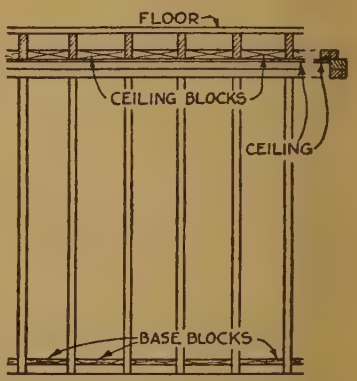


Fig. 15. Where blocks must be provided for nailing on wall boards.

Insulating Wall Boards

Wall boards are obtainable that are ⅜, 7/16, or even ½ in. in thickness. They are wide enough to cover three spaces of studding or joists—that is, 48 in.—and extend from floor to ceiling.

Short pieces of wood must be nailed securely between stud and joists wherever the ends of the boards happen to come, and the loose ends nailed to them; otherwise the board in time may bend at these points. About 4 in. above the floor line, a row of these pieces must be put in, and also along the ceiling line. A 1-in. lath must be nailed up to receive the ends of the ceiling boards; that is, if the studs are carried up through. The ceiling blocks also may be as shown in Fig. 15.

Do not spare these fillers and leave any end joints unsecured, or the work will be imperfect. Use the nails advised by the manufacturers, and do the filling and finishing according to their directions.

Fiber and Composition Boards

Fiber and wood composition boards ordinarily are thinner than those just described. They require blocks to which to attach the ends, in the same manner as the thicker boards, and are nailed with fine nails as designated by the makers.

Plaster-filled boards, 4 ft. wide and of lengths to reach from floor to ceiling, also may be obtained.

Frequently the joints, instead of being filled, are covered with strips of wood to form a paneled effect. A great variety of designs are possible. The manufacturers will furnish designs and sometimes plans if dimensions of the room and other necessary information are given.

The great point to remember is that no loose ends must be left anywhere; blocking must be placed behind to be permanently satisfactory; even an end only 1 ft. long must be nailed.

"Dry Fill" Insulation

When a low ceiling attic has been left unfloored, a "dry fill" or loose insulation may be used. The fill must not be dumped right on to the lath and plaster of the ceiling below; preparations must be made as follows: Nail strips of wood about 1 by 2 in. wide on each side of every joist about 4 in. below the top edge. On these cleats are laid —not nailed—pieces of common board, cut in short lengths; this forms a box about 3 in. deep in which the fill is placed (*A*, Fig. 16).

Mineral wool and various good dry fills are obtainable. No fill

Fig. 16. Methods of insulating with "dry fill" and "quilts."

should ever be used that is not absolutely vermin-proof. Sometimes sawdust has been used for this purpose, but it is a fire hazard and, after it becomes packed down, makes a fine home for mice.

Insulating Quilts

Insulating materials are manufactured in the form of household quilts, not, of course, of wool but of vermin-proof materials made in the form of narrow rolls a little wider than the usual openings between floor joists and wall studs (16 in.). These may be hung up like curtains wherever open recesses are found, and serve a useful purpose where a loose fill could

not be easily retained in place, or where more expensive wall boards are not required (*B*, Fig. 16).

How to Build Cedar Closets

One of the more ambitious projects for the home worker is the building of a cedar closet. This may be done either by building a complete closet—usually placed in the storage room in the attic—or by lining a closet already built.

Aromatic red cedar is prized for its beauty, its odor, and the sentiment attached to it through its long use in chests, and unquestionably a cedar closet increases the value of a house. However, any other good wood will do.

Plain boards, whether thick or thin, are not the most satisfactory for this purpose. For wide surfaces either loose panels in frames or tongue-and-groove strips (called "ceiling") are preferable. Panel work here is unnecessary, so when purchasing the cedar at the mill, if it is not already in tongue-and-groove form, have the dealer rip and "stick" the boards on a machine to make tongue-and-groove edges; unless, indeed, you have a pair of match planes or are the happy possessor of one of those fine hand combination tools which have knives for all kinds of work. In any case, have the boards ripped by machine to a width of 2¾ or 3¾ in. or however the boards can be divided most economically. The standard thicknesses of ceiling are 7/16, ½, ⅝, ¾, and ⅞ in.

In figuring up the area to be covered, allow one fourth more for machining and waste if the ceiling measures about 3½ in.; allow more if it is narrower.

To line a closet, do not attempt to cut in between shelves and wall cleats. Remove all shelves, cleats, and fixtures, also the molding on the top of the base, and the wall molding around the trim of the door. Do not remove the base.

Measure for the top first; cut the pieces ¼ in. short and nail them in place at an angle through the tongue as with flooring. Finishing nails driven through the lath and plaster and an occasional one in the studs will suffice.

Having the top in place, cut lengths for the sides, fit them tightly on top of the base—they may be loose at top—and nail as before, especially well at the occasional studs, which will be 16 in. from center to center. Fit a piece of old wall- or base-molding around the angle of ceiling and wall to cover the open joint, and replace the fixtures.

If it is desired to cover the door also, first close the door and mark it all around the stops. Cut lengths to extend slightly less than these marks so the door will close. Nail into the rails, stiles, and muntins only, not into the panels.

Making a Storage Closet

A cedar closet forming a complete inclosure and standing alone must first have a frame. Rough 1¾ by 2 in. pieces are heavy enough, but they must be straight

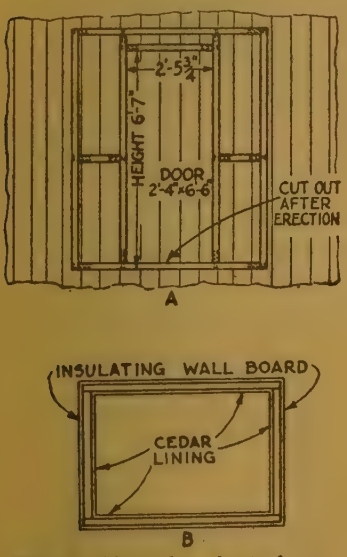


Fig. 17. After the closet frames are built on the floor as at *A*, they are stood up and finished as in plan view *B*.

and dry. This size or a stock size a little larger may often be obtained at the mill.

Any size desired may be built, but for ordinary usage about 6 ft. wide, 4 ft. deep, and 7 ft. high——outside measurements—should be sufficient.

Cut the pieces and make the frame on the floor as shown at *A*, Fig. 17. Obtain the door to be used before making the frame; 2 ft. 4 in. by 6 ft. 6 in. is a small, standard-size door. Have the door opening 1¾ in. wider and 1 in. higher if the jambs are to be ⅞ in. in thickness; if thinner or thicker, be governed accordingly. Nail the frame together as shown. Cut out the bottom piece last, after the frame is nailed together and in place.

Make the back the same way without the door opening; the sides also, deducting the thickness of front and back, which overlap them. Having nailed the four sides together on the floor, with the aid of a helper stand them up and nail at the corners (see *B*, Fig. 17). The top may be made to drop inside and be nailed from the outside, or it may be made to outside measurement and set on top; in either case it must be squared carefully.

If due allowance is made for the overlap of both frame and cedar lining, there is no reason why the tongue-and-groove lining may not be nailed on the frames while they lie on the floor, a much easier way than after the framework is standing up in place.

Make door jambs wide enough to come flush with the face of the inside lining and the face of the outer covering. Nail the jambs in place. Be careful to plumb and square the case beforehand, in its

proper location, and secure it so that it will so remain until finished.

There is nothing better for the outer covering than one of the insulating boards previously mentioned.

A plain base should be placed, and the door trimmed. Applying the hinges, lock, and stops is all that remains to be done, except, perhaps, to finish with a crown molding at the top.

Information about hanging a new door and fitting locks, hinges, and the like may be found under the corresponding headings in this chapter.

Shelving, cleats, hook rails, and other fixtures may be made out of the same tongue-and-groove material. When a pole or two is added for the hangers, the work is completed.

If the closet is to stand against a wall, the framework for the back may be omitted and the ceiling nailed to the plastered wall, as in lining a cedar closet.

General Purpose Shelves and Closets

The construction of shelving seems to have followed a process of evolution. One of the very simplest forms, if not the very simplest, is described and illustrated in a basement preserve closet (see Fig. 3, page 42). This method of construction is shown, in brief, also at *A*, Fig. 18. The next step in development was to place strips (cleats) under the ends of each shelf, instead of nailing through the ends; this method is shown at *B*. Further advancement was made in doing away with cleats as at *C*, Fig. 18. This method uses few nails or none at all, except at top and bottom; this is called dadoing and consists in cutting grooves to support the shelves as shown. If the shelving is over 4 ft. long, bearers or divisions are required; these are dadoed in also in this form of construction; in methods *A* and *B*, they are simply nailed in.

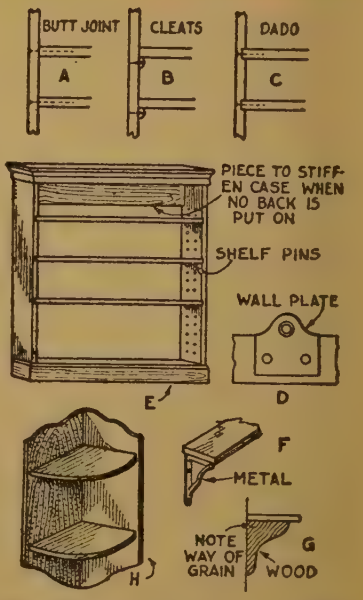


Fig. 18. Joints for shelves; wall and corner shelving; and shelf brackets of wood and metal.

For other shelves, without ends or standards, metal or wood brackets are used; see *F* and *G*, Fig. 18. Another very strong method of making wood brackets is shown in Fig. 3.

A useful form is a case dadoed and glued together with rows of small holes in the ends, or standards, as at *E*, Fig. 18. In these holes metal shelf pins are placed to allow the spacing of the shelves to be of any height desired.

For hanging wall shelves a metal hanger plate is used as shown at *D*, Fig. 18. Plates of this kind may be obtained at many hardware stores. This hanger is so located on the back of the fixture that the supporting screws or nails may be driven into a wall stud in a plastered wall or either in the mortar joint or in a wood plug inserted in a brick or other hard-faced wall.

Metal brackets—to be purchased everywhere—are serviceable in many places (*F*, Fig. 18). If they are to go on a plastered wall, the wall should be tapped gently with a hammer to find where the studs are located. Indications of these also may be found by looking for the nail heads in the baseboard; the putty usually can be seen. By allowing 16 in. for each stud space, the other studs may be found. In this case set your brackets with a long, thin 1¼-in. screw, as lath does not give a permanent grip for screws and less for nails. Wood brackets (*G*) are attached in the same way.

A corner shelf is serviceable in many places. From the illustration *H*, Fig. 18, it will be seen that one may be readily nailed together. The sidepieces are of plywood, and ½- or ⅝-in. shelves are used. With straight-edged shelves, light doors may be added.

The form of shelving shown at *E* is of general use in almost any room. Trimming pieces may be added, a small molding placed at the top, and a light base at the bottom. If the shelves are narrower than the top and sides, doors may be fitted; see the section on hanging a new door. Before the case is made, a pair of doors or a single door of stock size should be bought, also the shelf pins, if they are to be used, so that the holes may be bored the right size before assembling the case.

A proper understanding of the form of construction outlined above gives the key to all the others. For, beginning with a mere skeleton form as shown in a basement preserve closet (Fig. 3), one may go on to add a base strip, then a top piece with molding, as in Fig. 18; next, face strips at the ends, called hanging stiles, and on these again, ornamental strips, called pilasters.

Having mastered this form of construction, one may make closets of all sizes for any room.

How to File Keys

The tools needed are a vise, a few warding files, and frequently a hack saw and an awl. A 4-in. flat warding bastard file (Fig. 19) is useful for cutting rectangular notches in the ordinary tumbler

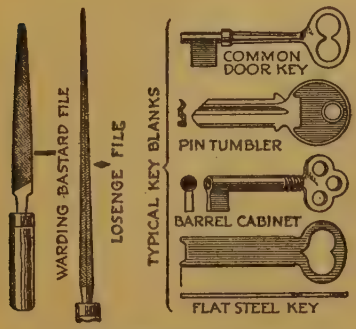


Fig. 19. Warding and lozenge files, and four types of key blanks.

lock key, and the lozenge file, such as is used in the shop for sinking dies, is convenient for filing the V-wards of a pin tumbler key.

In purchasing a blank key at a hardware store, choose one as nearly the size and shape of the original key as possible. If the original key is available, the making of an exact duplicate merely requires that one mark and file the blank carefully and check frequently. A ward cut too deep will ruin the key.

If the key is of the pin tumbler type, clamp the blank and the original key together in proper alignment in the vise and file the notches in the blank with a lozenge or other suitable file as shown. The original key serves as a template.

When the original key is missing and the lock is of the common variety, hold the blank over a lighted match or candle until it is blackened, insert it in the lock and turn it hard, pressing tightly. Remove the key and file where the soot has been removed.

It is impossible for the amateur to fit a key of the pin tumbler type to a lock. A key of that type, therefore, can be made only by copying an existing key.

If you do not care to attempt the fitting yourself, you can remove the lock from the door in a minute or two and take it to the locksmith or the neighborhood hardware store, where a key generally can be made without delay. Having all kinds of blanks on hand and all tools required for the purpose, the mechanic finds it a simple matter.

How to Remove a Lock

A rim lock, being screwed on the outside, needs no explanation as to its removal, except that the door knob on one side only must be taken off first by unscrewing the small set screw which fits into the spindle through the knob; this allows the handle to be pulled out. It is well to screw the knob on again without the lock so that no part will be mislaid.

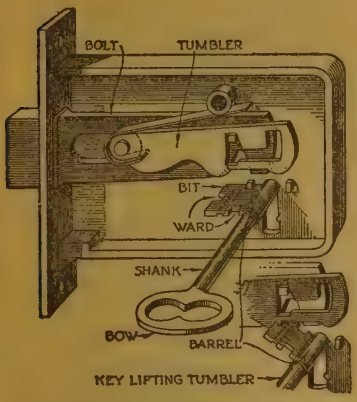


FIG. 20. In a common lock, the key raises the tumbler, then moves the bolt in or out.

To remove a mortise lock, take off the handle in the manner just described and then unscrew the two screws in the selvage of the lock on the edge of the door. By inserting your screw driver in the keyhole and prying forward gently, the lock may be pulled out. Replace screws and knob as before.

REPLACING A BROKEN LOCK SPRING

When the latch no longer springs forward or back, the lock must be removed and laid flat in a safe place and handled with care if all the parts are not to be jumbled together. Remove the small screw holding the faceplate and lift it carefully. Take out the broken spring and make another of the same size. Lock spring may be obtained in the form of a coil and may be broken by bending it back and forth in a vise or with pliers. Study Figs. 20 and 21.

New door knobs, spindles, set screws, and other parts may be bought at the hardware store. A door knob which has come off the spindle may be replaced by setting the spindle in the knob with a mixture of iron cement and water, and allowing it to stand until set. Loose escutcheon screws, having no hold in the thin shell of wood outside the mortise lock, may be fastened

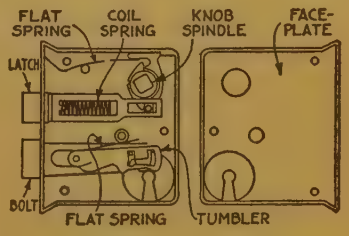


FIG. 21. Inside of ordinary mortise door lock, showing springs.

with the same cement. This is cement that hardens and looks like iron. Plastic composition wood also is useful instead of wood plugs for this purpose.

BUILT-IN IRONING BOARDS

New houses frequently have built-in ironing boards. In old houses which lack them the home mechanic may well undertake the construction of one. Directions for cutting

the plaster are given in the section on cutting an extra doorway in this chapter.

The folding ironing board and cupboard illustrated in Fig. 22 is of very solid and simple construction. No braces are required to support the end of the board and therefore there is nothing in the way on the underside. Dimensions may be varied to suit the builder,

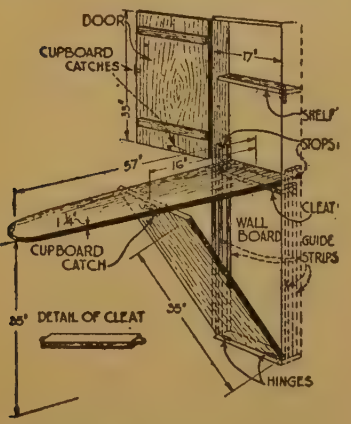


FIG. 22. When open, the lower door supports this ironing board.

but those indicated have been found satisfactory.

The cabinet is the depth of the wall studding.

It is lined with ¾- or ⅞-in. lumber on the top, bottom and sides; the back is a sheet of neatly fitted wall board. The casing around the cabinet matches the trim around the kitchen doors and windows.

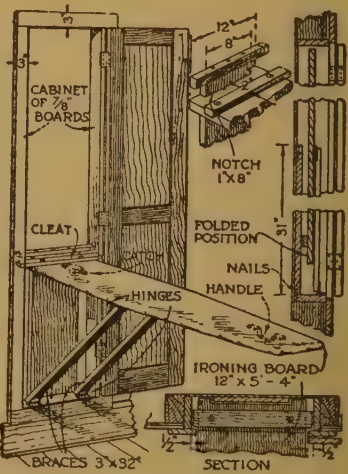


FIG. 23. Another simple ironing board that folds into the wall.

Two doors for the cabinet are provided. The top door is opened first. The board itself then is grasped and pulled upward until the end cleat reaches the stops on either side. Next, the lower door is swung out and the board is let down on it.

A shelf is provided near the top of the cabinet for the iron and rest when they are not in use. When an electric iron is used, the plug may be put in the wall of the cabinet.

In the second method illustrated (Fig. 23), it is necessary only to pull the board down from the top. It automatically raises at the base and slides into position, where it remains firmly fixed. There are no loose props or legs to give trouble.

CHAPTER III

PATCHING AND PAPERING WALLS

THE most carefully constructed house will suffer from the settlement of the foundation and the seasoning of the frame. Cracks will open in the walls and ceilings. In a few cases, only skilled treatment can remedy them, but ordinarily all such repairs can be done by any handy man, if the right materials and a little information are available.

In preparing for a repair job on the walls or ceilings of a house, it is advisable to spread old cloths or newspapers on the floors and other horizontal surfaces as a protection from dropping liquids, plaster, paste, or tools; and to provide stepladders, planks, and other aids needed to reach the work in safety.

How to Patch Plaster

If the plaster surrounding a hole or crack gives when pressed by hand, it should be removed. Cut out the loose plaster near the sound edge and remove the pieces released. Push a putty knife or a pointed trowel under the remaining loose plaster and break it away, but hold the other hand firmly against the surface to prevent breaking beyond the clinch (Fig. 1).

Be sure the old plaster is pushed out between the laths to allow the new plaster to make a perfect clinch, and see that the edge of the hole is undercut to hold the patch.

For large patches the home worker will find patching plaster, which can be purchased at paint and hardware stores, or prepared gypsum plaster, which is sold by dealers in masons' supplies, more satisfactory than either lime plaster or ordinary plaster of Paris. Mix one part of coarse clean sand and two of plaster, making it as stiff as it can be worked; then fill the space to about ⅛ in. of the surface.

Wet the patch edges and laths, and push the new plaster well through the laths with a laying trowel (Fig. 2). The inexperienced worker will find a putty knife is convenient to use around the edges. These tools cost little, but in their absence, similar tools may be made of wood.

Large patches of plaster will hold better if common nails are driven

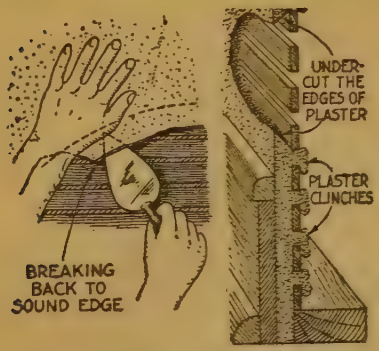


FIG. 1. Method of breaking away loose edges of plaster.

into the wood studs or laths. Sink the heads well below the surface of the wall.

After the plaster is reasonably hard, scratch the surface with a nail or screw driver to hold the finishing coat. Fill the remaining ⅛-in. space with clear plaster. If prepared gypsum plaster is being used, pass it through a fine mesh—a flour sieve, for example—to remove the fiber, and strike it off smooth with a straightedge. Smooth the face with the wet laying trowel and dust on a little of the dry sifted plaster.

If a rough surface is desired, tack a piece of old velvet carpet around a block, dip it in water, and use it with either a rotary or a stippling motion.

If cracks show around the patch, apply a thin mixture of sifted plaster and water the same way. Should a large part of a wall space require the patching, it usually is better to remove all the old plastering and have a mason replaster.

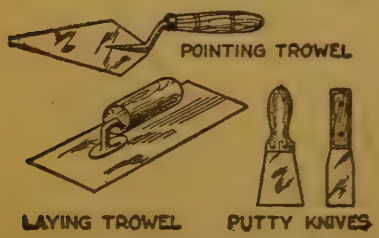


FIG. 2. Trowels and putty knives for patching plaster.

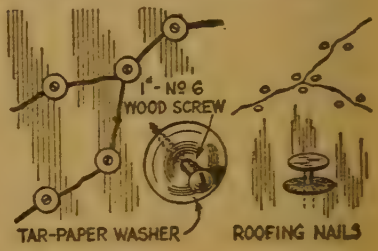


FIG. 3. Two ways to hold loose plaster when appearances are not of primary importance.

REPAIRING LOOSE OR CRACKED PLASTERING

Loose or cracked wall or ceiling plaster sometimes may be repaired, when appearances are not important, with tin washers (Fig. 3) of the type used in laying tar-paper roofs. The washers are fastened with thin flathead wood screws on walls, and with three-and-a-half-penny common nails driven slantingly on ceilings. Place the washers at 2-in. intervals along each crack and space

them 6 in. or more apart over the entire area of loose plastering. When whitewashed or painted over, these fasteners are not very noticeable from a distance. For best results, paste a 4-in. strip of cheese cloth over each row of washers, fill it with patching plaster, and sandpaper the edges when hard.

Large-headed roofing nails (Fig. 3) also may be used if they are driven into or near a wall stud. To lessen the vibration, it is best to make awl holes somewhat smaller than the nails through the plaster and lath. Countersink the surface of the plaster to allow each nail to be driven flush. The nails should be staggered each side of the crack.

Making a New Clinch in a Plaster Ceiling

Although the breaking of a ceiling clinch and the consequent sagging of plaster is not easy to remedy, the clinches may be replaced and a repair made in the following manner:

Make a slat-work grill with about ½ by 2 in. slats and ⅞ by 2½ in. cleats, say 18 by 36 in. over all (Fig. 4). Force it against the ceiling to support both sides of the crack and hold it there with struts. Drill holes ½ in. or larger, as at *A*, 4 to 6 in. apart, through the plaster and lath (and furring, if necessary). Make the hole through the plaster larger on the outside as indicated. Wet the dry plaster with a brush or spray, mix plaster to a consistency that will flow, and fill a grease gun with it. With the gun push a piece of doubled and knotted soft string through each hole for reinforcement as at *B*. Force enough plaster through the gun to form the

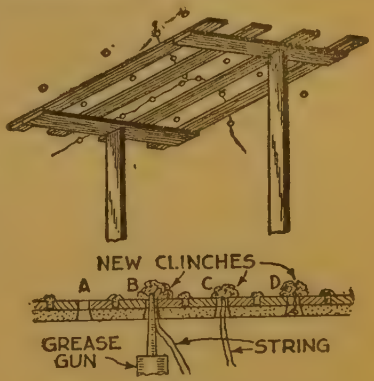


Fig. 4. Applying plaster to make new clinches in a sagging ceiling.

new clinch and to embed the knotted string as at *C*. Withdraw the gun, cut the string about 1 in. below the ceiling, turn the ends into the hole, and finish the surface flush with a putty knife as at *D*. Do this where necessary and leave the grill to support the plaster until the clinches have hardened thoroughly.

Repairing Small Defects

If a wall is to be papered, small cracks, small screw holes, and nail holes less than 3/16 in. across are not

likely to show through the paper. When a wall or ceiling has a network of fine "fire" cracks and is to be painted, apply a size coat consisting of equal parts of varnish and turpentine. Mix in also a little white lead or flat wall paint and a handful or two of dry, fine pumice stone. The pumice stone gives the size a slight "tooth."

A second method is to size the wall with a mixture of one gallon of boiled linseed oil and one quart of turpentine. In bad cases it is well to fill the larger cracks of this type before the varnish size, or before or after the oil size, is applied. Thin some white lead-in-oil paste or flat wall paint with a little turpentine, run a stripe over each crack, let it set about five minutes, and rub well into the cracks with a rag.

Patching Small Blemishes

The tools needed for small patches are a putty knife and a flat paddle 1 in. wide whittled from white pine for putting on the finishing touches. A small pointed trowel is handy for spreading the material and for smoothing it. The material best suited for the amateur's use is prepared patching plaster, but plaster of Paris also will serve for small patches.

If a wall is to be painted or enameled, the patches should be given a coat of thin orange shellac; if it is to be papered, kalsomined, or covered with fabric, a coat of glue size will be better.

A good second filling for holes when either patching plaster or plaster of Paris and sand is used for the first filling, is a putty made from white lead-in-oil paste stiffened with whiting. Add a teaspoonful of japan drier to two pounds of putty, knead well, and apply with a wide putty knife. Such a filling can be smoothed nicely and does not require a shellac coat to seal it. The margin of plaster around it should be shellacked and touched up with flat paint.

Other putties can be made by adding dry whiting to any flat wall paint or to white lead paste thinned with a few drops of linseed oil.

With the exception of plaster of Paris, all the materials mentioned set slowly and allow plenty of time for the work. Methods of using plaster of Paris are given farther on.

Rough, sand-finished plaster walls are treated in the same way except that in both the first and second filling of large cracks and holes it is necessary to add clean dry sand which has been sifted through a fly screen. While the final filling is soft, stipple it—that is, pound it with a stiff dry brush—to make the filling match the adjoining texture.

If color is wanted in the putty, add dry colors such as raw sienna for yellow, burnt sienna for reds and pinks, raw umber for grayish

brown, and burnt sienna for walnut brown. Vandyke brown also is used and mixtures of these colors can be made to gain the exact shades. Dry colors are used to tint both water and oil putties, or a small patch may be matched with water or oil colors. If a rough surface is to be matched, add clean and rather coarse sand.

Concealing Cracks

Cracks in papered walls should not be filled until the time comes to repaper, but they may be concealed temporarily by pasting a strip of wall paper 2 in. wide the full length of the crack. Take care to match the figure accurately.

Plaster of Paris is used extensively by professional painters for patching small defects and can be applied by the amateur, although patching plaster, when available, is more convenient to handle and has the advantage of shrinking less.

To use plaster of Paris, place a little of it in a clean can and cover it completely with water. It will keep indefinitely as long as it is submerged, but will begin to set a few minutes after it has been removed from the water. It should not be used in that condition.

A little dry whiting or hydrated or slaked lime added to the plaster of Paris slows down its setting. Take out a handful and knead it with your fingers until it becomes plastic like bread dough. Fill the crack with this putty, after first wetting the opening with water. Crowd the putty down well with a putty knife or spatula and smooth it off. Wipe off the surrounding surface with a damp cloth.

To delay the setting of plaster of Paris, various methods are used, although none is completely satisfactory; and no matter what is done, the plaster shrinks to some extent. One method is to mix two parts of plaster of Paris and one part of hydrated lime with thin glue or decorators' size.

When considerable patching is to be done it will be worth while to make a "hawk" (Fig. 5) from thin

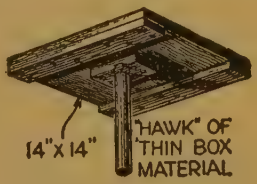


Fig. 5. Board for mixing and holding patching plaster.

box material with a broken broomstick for a handle. On this small batches of patching plaster may be mixed and carried conveniently.

If commercial patching plaster is used, add water slowly and do the stirring with a large spoon or a small trowel or table knife until a stiff mixture is obtained. When working, hold the hawk to keep the plaster from dropping on the floor. Plastic paint, which comes in

powder form, serves as another type of filling. When wet, it can be used the same as plaster of Paris.

Repairing Broken Plaster with Wall Board

The handy man can make a badly broken plastered wall attractive at little cost and with a minimum of disorder by using one of the numerous varieties of wall board on the market. These can be obtained at practically any large lumberyard.

Plaster wall board may be applied in such a way that the joints may be filled with a plaster composition and the wall then papered. This is an inexpensive method, but the seams are apt to show through the paper in time unless reinforced.

Unless the plastering is in very bad condition, it does not need to be removed; but all holes in it which are over the studding where joints of the wall board will come should be filled level with wood or with wall board to insure solid nailing through the wall board, plaster, and lathing into the studding.

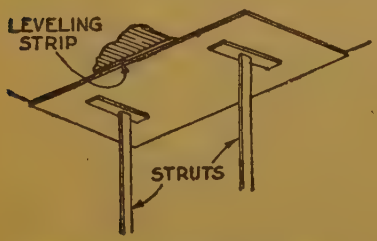


Fig. 6. How T-struts are used in applying wall board.

The wall board may be cut with a rather fine saw or a knife and fitted carefully around all openings. All joints should come over studs, which may be located by tapping the walls. If the boards are laid directly upon laths, fourpenny common nails will be long enough, but if laid on plastering, fivepenny nails should be used; galvanized nails, however, hold better and do not rust. Be sure each nailhead is flush with the board or a little under it.

How to Apply Wall Board on a Ceiling

Fitting and nailing wall board to a ceiling is a little more difficult than laying it on side walls, especially if you are working alone. Two T-struts (Fig. 6) are effective helpers and can be made easily.

Another useful accessory for either old or new work may be made by hinging two boards—which should be about 6 in. wide and as long as the room is wide—to the plate or studding as shown in Fig. 7. This illustration shows the application for new rather than old work, but the principle is the same in both cases. The boards are about one half the length of a sheet of wall board apart and they are below the ceiling by the thickness of the wall board.

Tie a rope around the free end

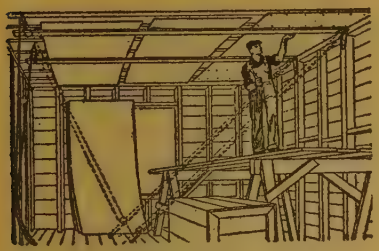


FIG. 7. The wall board is raised to the ceiling on long, hinged boards.

of each board and pass it over pulleys or over the joists or rafters above, if they are exposed. Place the wall board sheets on the two boards, resting on a cleat nailed on each board near the free end; then draw them up to the ceiling and hold them there. It is comparatively easy to shift the wall boards into position and nail them.

How to Conceal the Joints

The manufacturers furnish such complete instructions that there should be little difficulty in applying wall board, but when it is in place, the question arises as to how it is to be decorated. There is a choice between filling the joints to conceal them or covering them with wood strips. When wood strips are used, the placing of the wall board to make well arranged and proportioned panels must be carefully planned in advance.

In almost every case the joints can be concealed permanently if careful work is done. Allow at least ⅛ in. between edges of the wall board to hold the filling putty, unless the manufacturer specifies to the contrary; some plaster boards are butted tight together.

The first operation, after the board is laid, is to brush glue size well into the joints or over the whole wall, unless the wall is to be painted, in which case a varnish size should be used to cover the entire surface, as it will save at least one coat of paint.

Various kinds of putty are sold for this work, but satisfactory results may be had by filling the joints with one of the plastic paints sold for doing textured wall decorations. These come in dry powder form and are mixed with water into a stiff putty about like bread dough.

Before filling the joints, have on hand a sufficient number of strips of open-mesh canvas (or special soft wire screening made for the purpose) 3 in. wide to cover all joints, as well as to place in all corners of wall and ceilings. Open-mesh canvas is a strong fabric similar to cloth mosquito netting, but heavier. It may be purchased through decorators and paint and wall paper stores. Without reinforcement of this type, the joints will crack in time.

Fill each joint with putty, allowing it to spread about 2 in. on each side of the joint. While the putty is wet, place over the joint a strip of the canvas or screening. Pound it

down in close contact with a brush of some kind (a shoe brush will serve); then apply more putty on top of the canvas and scrape it down with a wide putty knife.

Work the putty to a feather edge on both sides. You can smooth up the joint by scraping it with the knife. The fabric is thus embedded in the putty and securely cemented to the wall. The surface may be painted, kalsomined, or completely covered with canvas, burlap, or wall paper.

Making Wall Board Panels

If joints between the boards of the wall and of the ceiling are spaced carefully and are covered with "batts" or decorative wood strips, ½ by 1½ or 2 in., either with or without mitered panel moldings, an exceptionally attractive room will result. Suitable panel moldings may be found in any lumberyard. Note that the wall board starts from the baseboard as at *A*, Fig. 8, and the panel strips from the base molding, *B*.

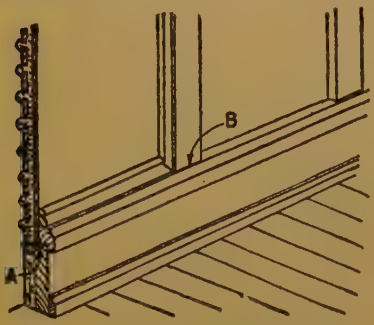


Fig. 8. Wall board paneling with and without moldings.

While panels may be adapted to almost any arrangement of joints in the wall board, the joints must be planned before the wall board is cut.

Few rooms are so designed in the grouping of door and window openings that the wall and window panels can be arranged symmetrically. Usually it is best to divide the ceiling evenly into panels and group the wall panels into openings.

Since all wall board edges must have solid backing, the most inexpensive job results when only the studs already in place are used. A better design is often possible, however, when the plaster and lath are cut away and an extra stud inserted where a well formed panel cannot otherwise be obtained. It is well worth while to take this special pains with a few joints. In some cases, heavy paper may be pasted over an entire panel to conceal a joint that has come in an awkward place, but it is a makeshift at best and is almost certain to show in the course of time.

Sizing New Plaster and Wall Board Surfaces

The following suggestions apply to both walls and ceilings. Many expert paper hangers wash a new wall (especially one which has stood

for some months) with warm soap and water, or soda solution, and go over it with hot alum water or formaldehyde for hygienic reasons.

Often a wash of vinegar is used to prevent the action of new lime on both paint and paper. If the wall is rough coated, it may be necessary to go over it with No. 2 sandpaper on a block of wood. A very rough wall should then be sized, given a coat of paste, and allowed to dry.

When the ceiling and walls are completely cleaned, they must be sized. Paper hanger's size may be bought ready for mixing with water, or ordinary glue size may be made without difficulty. Soak a pound of paper hanger's dry glue twelve hours in enough cold water to cover it. Then add ten quarts of hot water and a tablespoon of powdered alum, or proportionate quantities may be used. One quart of the size will cover from fifty to seventy-five square feet of wall area.

Wall boards should be glue sized, especially pulp boards with glossy surfaces, before being kalsomined or papered—although fiber boards are rarely papered. A varnish size insures better results if the wall is to be painted.

Removing Kalsomine, Whitewash, and Wall Paper

All whitewash or kalsomine should be washed from ceilings and walls that are to be painted or papered. A wide brush or sponge is best for this purpose. Use a solution of 4 oz. of washing soda and 6 quarts of warm water and then scrape those portions that do not come off with washing. Warm water alone will give very good results. Wash any soda solution from all woodwork immediately so that it will not soften or darken the paint.

If the ceiling is to be left unpapered, paint or tint it in the usual manner before repapering the side walls. If it is to be papered, wash it anyway and size it, using paper hanger's size or glue size.

Anyone with the necessary patience can remove paper, if the walls are thoroughly wet. One method is to coat the paper with hot paste and after it is thoroughly absorbed, brush the surface several times with hot water. A simpler way is to apply hot water alone with a brush, sponge, or a garden sprayer of the hand-pump type.

Start at the top and tear the paper down. Remove a layer at a time, if necessary, and where the paper is hard to pull off, use a wide putty knife or an old case knife. Care must be taken not to dig into the plaster.

Do not hesitate to lay new paper on old if the latter is perfectly tight, but if there is more than one thickness of old paper, it is better to take the old paper off. Take it off completely or the edges will show through the new paper. Finish the

job by washing the walls with clean warm water.

Varnished papers, such as are used in bathrooms and kitchens, will not respond to the clear water or paste treatment. Scratch the varnish with No. 2 sandpaper and wash with a strong solution of washing soda. The same treatment will be effective in removing heavy papers and fabrics. In stubborn cases it may be necessary to use a commercial paint remover.

Just before hanging the paper, go over the wall with No. 2 sandpaper to remove minute pieces of paper, lumps of paste, or sand. Inspect carefully for holes or cracks which need filling and repair them in the ways explained previously for repairing small defects.

If the wall was covered with closely sticking paper, it will not need sizing. If, however, the previous covering did not adhere well, or if in a glancing light the surface is smooth and glossy in some places and rough in others, it is better to size the entire surface.

Before sizing painted surfaces which are to be papered, repair all holes and cracks. Wash with a solution of 1 pint of common ammonia to a gallon of water, or with a soda solution. Scratch the surface thoroughly with No. 2 sandpaper over a block, especially around corners and openings and along the baseboard, for wall paper sticks no better than its edges. To two quarts of glue size add a pint of cheap molasses or a pound of brown sugar.

Some paper hangers make a size for painted surfaces of one quart of vinegar and one pound of brown sugar. This is used more especially if fabric is to be spread and where the painted walls are unusually greasy. If heavy paper or fabric is to be used, there should be less water in the sizing.

Varnished or gloss-oiled walls should be treated like painted walls. To test any size, paste a piece of paper on it. After about an hour pull it off; if it tears or splits, the size is all right.

Laying Cloth Backing

When a board wall or ceiling or a doubtful plastered wall is to be papered, a good second-class job may be done by covering the wall with cheesecloth. For best results sew these pieces together with a smooth seam and treat the cloth for each wall as one piece.

Spread the cloth without wrinkles, and drive 10-oz. lace tacks into a plastered wall, or 4-oz. carpet tacks into a board wall, about 2 in. from the outside edges. If preferred, spread the cloth smoothly with vertical joints and drive the tacks quite closely to the selvage edges of the middle breadths. Draw the cloth smoothly with moderate tension. In either case, cover the entire wall

with a liberal coat of glue size, which will draw the cloth tight as it dries and hardens.

Tools for Paper Hanging

The tools needed for hanging paper, or at least workable substitutes, may be found in most homes. There should be a couple of wide boards covering a width somewhat greater than the width of the paper to be pasted and 6 to 7 feet long, to be used for cutting and pasting, or a large wood-top kitchen table. A straightedge (Fig. 9) of about the same length will be useful.

Stepladders and plank for staging will be needed although the plank may rest on boxes or chairs. A soft brush for paste, usually 5¾ in. wide or wider, and a 10 or 12 in. short-bristled smoothing brush should be at hand; a whisk is a good substitute for the latter. A photographic roller, or a roller made of any smooth piece of round wood, 1½ or 2 in. in diameter, will be useful for rolling seams and in smoothing wrinkles and bubbles. A wide flat caster will be a fairly good substitute.

A pair of 12-in. shears will be just the thing, although a large pair from mother's workbasket will answer the purpose. There should be a trimming knife, for which a well-sharpened common paring knife will serve, although most professionals prefer a curved knife. A plumb bob may be made by tying a weight to the end of a string. A chalk line of any hard-twisted fine cord and a piece of colored chalk will be needed; also a paste pail and a moist sponge or cloth.

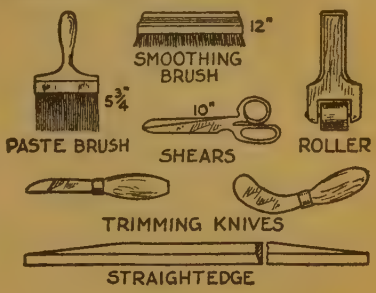


Fig. 9. Tools that are useful when hanging wall paper.

Dry and clean cloths should always be at hand for wiping paste from the fingers, from woodwork, and from the pasting board, for absolute cleanliness must be observed at every step of the hanging process.

Prepared paste, which merely requires to be mixed with water according to directions, is the most convenient for the home worker to use. To make flour paste, rub 3 lbs. of wheat flour through a sieve into 2 quarts of cold water and stir thoroughly. Then add 8 quarts of boiling water and boil slowly for ten minutes. This will make enough for the walls and ceiling of an ordinary room. Stir for ten minutes, allow to cool, and stir in two tablespoonfuls of powdered alum. Be sure that all

lumps are removed, using the fingers to find and crush them. Too often paste mixed by the amateur paper hanger is full of lumps or "kittens." An egg beater quickly reduces the paste to a soft consistency like oil or paint.

For light, cheap papers, a thin paste will give good results, but heavy and more expensive papers should be hung with a thicker paste. The more porous and rough the wall, the thicker the paste should be, while that for smooth, hard walls should be thinner. Do not thin paste to stretch it out; make more.

Paste to be used for hanging fabrics and very heavy papers may be strengthened by adding enough glue to equal about one quarter of the weight of the flour and two tablespoonfuls of Venetian turpentine to the quantity of paste mentioned above.

Measuring for Paper

The first move is to measure the room and consult the accompanying chart to find the number of single rolls of paper 18 in. wide and 8 yds. long you will need. For every two doors or windows of average size, you may deduct a single roll of side wall paper. Under the heading "side walls" you will see three figures. The first represents the number of rolls required if the height of the side wall is 8 ft., the second, if 9 ft., and the third, if 10 ft. high. Allowances have been made for waste in matching the design.

Usually wall papers are sold in double rolls—two single rolls joined as one—but estimates are based upon single rolls 18 in. wide and 8 yards long. Cheap papers may be a yard shorter. Duplex, ingrain, crêpe, cartridge, and oatmeal papers are usually 30 in. wide, and each bolt contains 3 single rolls 5 yards long.

Papering should not begin until all painting is done. Remove all

How Much Wall Paper to Order

Width of Room	Length of Room	Rolls for Side Walls			Rolls for Ceiling	Border in Yards
4	10	7	8	9	3	11
6	10	8	9	10	2	12
6	12	9	10	11	3	13
8	12	10	11	13	4	15
8	14	11	12	14	4	16
10	14	12	14	15	5	18
10	16	13	15	16	6	19
12	16	14	16	17	7	20
12	18	15	17	19	8	22
14	18	16	18	20	8	23
14	22	18	20	22	10	26
15	16	15	17	19	8	23
15	18	16	18	20	9	24
15	20	17	20	22	10	25
15	23	19	21	23	11	28
16	18	17	19	21	10	25
16	20	18	20	22	10	26
16	22	19	21	23	11	28
16	24	20	22	25	12	29
16	26	21	23	26	13	31
17	22	19	22	24	12	28
17	25	21	23	26	13	31
18	22	20	22	25	12	29
18	25	21	24	27	14	31
20	26	23	26	28	17	33
20	28	24	27	30	18	34

If the room is 8 ft. high, use the first figure under the heading "Rolls for Side Walls," if 9 ft., use the second figure, and if 10 ft., the third.

rubbish and be sure everything is clean.

Paper hanging is not hard to do, and anyone can learn to hang ordinary paper. However, if expensive or delicately tinted wall paper is to be hung, an expert should do the work.

Papering Ceilings

Amateurs may wisely decide to paint or kalsomine the ceiling, but whether kalsomined or papered, the work should be done before the walls.

The first strip of ceiling paper is hung to a chalk line parallel to the side wall and 16 in. from it, as shown in Fig. 10.

Cut the paper about 6 in. longer than the room. It is best to have all seams run toward the light. This is true whether making lap or butt joints. Cut five or six lengths at a time and spread them printed side

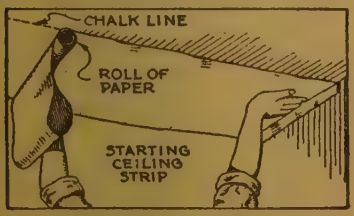


Fig. 10. Using a waste roll of paper to support a ceiling strip.

down, one over the other, on the pasting table.

Place the paper about 2 in. from

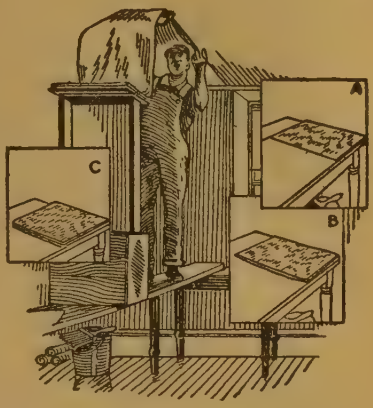


Fig. 11. Pasting and folding ceiling paper; another way to support it.

the edge of the table, draw the top strip toward you until the nearest edge is even with the edge of the table, and apply paste for about 3 ft. from one end, brushing over the edges outwardly. Double the paper about 1½ ft. from the end and fold the pasted surfaces together, taking care that the edges match exactly on both sides, as shown at *A*, Fig. 11. Pull the strip along until you have an unpasted length on the pasting table and apply paste to another 3-ft. length. Lift the paper at the place where the end has been folded over the pasted surface, and fold over the newly pasted section, as shown at *B*. Repeat this process until the entire strip is pasted and folded as at *C*.

Paste the edges by placing the hand under the paper so that the paste will not spot the strip under-

neath, as in Fig. 12. Wrinkles in wall paper usually are caused by not allowing the paste to soak sufficiently into the paper, which should be flexible from moisture. The wet brush should never be left lying on the paper.

To trim the edge of the pasted strip, stand facing the left edge of the paper and cut in a straight line with the shears through both thicknesses at once; that is, the folded portions (Fig. 13). If the cutting or trimming knife is used, lay a straightedge over the paper and cut by using its edge as a guide.

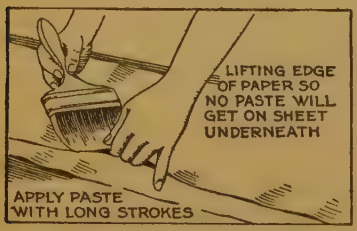


FIG. 12. The edge of the paper is lifted to prevent the paste from getting smeared beneath

Only one edge is trimmed for a lap joint. Some papers have a perforated edge so the margin can be torn off instead of cut.

Usually wall paper stores have a machine which trims one edge for lap joints, or both edges for butt joints. For trimming the paper, a safety razor blade is sometimes used by unrolling about 2 ft. of paper on the board, placing the blade on the trimming line, and drawing it toward oneself, the process being continued to the end of the roll.

A straightedge may be used in this operation. Another method is to hold the paper so the light will shine through from the other side, and follow the straight edge of the pattern with shears.

HELPS IN HANGING THE FIRST CEILING STRIP

Do not attempt to handle pasted and folded ceiling paper without a stand of some kind. One can be made by nailing two wooden strips inside a soap box, with another strip, 18 in. long, across the top of each (Fig. 11). On these, fasten a piece of heavy pasteboard, upon which may be placed the pile of folded paper. The stand may be pushed along as fast as the paper is raised from the pile.

Another method of supporting the folded strips is to nail a narrow board on each side of a stepladder so that it reaches within about 2 in. of the ceiling, and another piece across the top. The pile may be laid across this, and all are moved along as the work progresses.

The following method is often used by professionals in hanging the first ceiling strip: Lay the folded strip of paper over the left arm, mount the plank, and, facing the wall, begin at the right-hand corner of the ceiling. Unfold the end of the pasted paper and guide the outside edge along the chalk line, support-

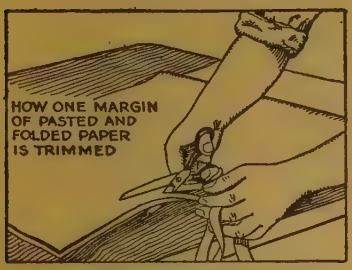


FIG. 13. One margin of the pasted and folded paper is trimmed.

ing the other folded end over the left arm. Lap at least 2 in. of the end of the strip on the end wall; lap the inside edge of the ceiling strip on the wall in front. Guide the paper with the right hand as you move to the left, pressing it to the ceiling with the flat of the hand and smoothing with the brush. When in place, use a spare roll of paper to hold the loose portion (Fig. 10). Unfold the remaining half and move along with it, using the roll to press it to the ceiling.

If wrinkles occur, pull the paper away and flatten properly. Paste another length and repeat the procedure, working with the back to the wall. See that the edges overlap so that one edge barely covers the other. When the second sheet has been applied, roll the seam with care.

If the room is a large one and difficulty is experienced in handling the long strips of paper, it is well to do more folding, that is, fold each strip in accordion or zigzag fashion about every 2 ft., paste side to paste side.

PAPERING THE WALLS

Methods of pasting and trimming paper to be hung on walls are the same as those described for the ceiling, but fitting the paper around the openings and corners requires care. In hanging paper on the walls of a room, begin in a corner. Work from the light towards the dark side of the room so the lap joints will throw no shadows; butt jointed paper may be laid in either direction.

A line should be plumbed on the wall to the right of the corner at a distance of ½ in. less than the trimmed width of the paper. This will insure the first strip's being straight. The plumb line may be used as a chalk line. In the same manner plumb every third or fourth strip to keep the joints exactly vertical. Drop the plumb line between two windows, if more than one strip is to hang there.

Cut a number of strips of the right length and match the figure as you do so, allowing at least 2 or 3 in. leeway. Lay the strips face down on the workbench and apply paste as explained for ceiling work. Pick up one strip and mount the ladder until the top of the strip can be unfolded and placed an inch or two below the ceiling. Be sure to

get the pattern *right side* up. Look down along the mark on the wall. Swing the paper so that the edge meets the mark and press the top of the strip against the wall with your hand or the smoothing brush (Fig. 14). Unfold the bottom por-

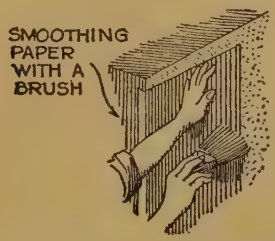


Fig. 14. How the side-wall paper is hung at a corner.

tion and smooth it down in the same way. Always brush from the outside edge toward the corner and allow the inside edge to turn slightly around in the corner. Brush from the top down. If the strip is found to be slightly out of plumb, lift the paper from the bottom and brush it in place again until it is smooth.

As a guide for the newly pasted strip, stick a tack or pin at the edge of the preceding strip near the bottom. Allow the thumb of the left hand to serve as a pivot, and the paper will swing into place.

After the two edges have come together, press lightly against the paper with the right hand; it can then be smoothed down.

Match all following strips and in the corners split the strip before pasting so that the design will match.

A strip around a doorway or window must be measured and cut while dry, allowing a slight advantage in size. Paste, fold, and hang. Where the paper laps over the woodwork, scribe a mark by pressing it lightly with the dull side of the point of the shears (Fig. 15). Cut to the mark and press the paper back in place.

After two strips of paper are laid, the joints should be rolled. This will give the paste a chance to set, and it will not be squeezed out.

In hanging varnished papers of tile or brick pattern, especial care

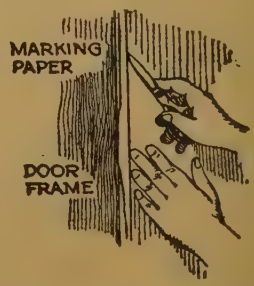
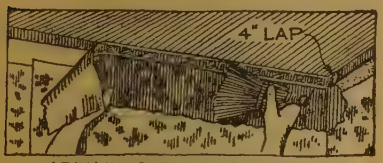


Fig. 15. Marking paper where it laps over the woodwork.

must be used that they are hung plumb and that a line of full tiles shows at the bottom. Lay the straightedge on the selvage in cutting varnished papers, and do not fold them sharply or the varnish may crack.

Varnished paper is more difficult to hang than ordinary paper. Make the paste a little thicker than usual and paste two or three strips before hanging the first one.

The hanging of the border comes last. It may be cut into any convenient lengths—not too long—for



APPLYING THE BORDER

Fig. 16. The border covers edges of ceiling and wall strips.

hanging. Paste, fold and trim; then hang the first piece by unfolding the right end and pasting it to the wall in the corner, lapping the end about 4 in. around the corner (Fig. 16). If the ceiling is uneven, snap a chalk line across the wall as near the ceiling as possible.

If the joints in the border come in a conspicuous place, or, indeed, if tears occur in any strip of the side wall or ceiling paper, they can be patched by feather-edging the joint. This is done by tearing in an irregular fashion the edges that are to lap the design and undertearing them so the edges will be thin.

Plaster Wall Fastenings

Nails will hold in plaster walls only when driven through the plaster into one of the wall studs. To find one of these, tap the wall very gently with a hammer and listen to the sound. The sound is hollow in tone except where the studs are located.

If you find you cannot detect this difference, look at the baseboard and note where it has been nailed. The nails are driven into the studs, and there is usually good nailing at any point in a vertical line directly above them.

If it is necessary to fasten anything to a plastered wall at a place where no stud can be found, obtain a toggle bolt (Fig. 17) of suitable size and drill a hole to receive it. Plumbing fixtures, clocks, shelf brackets, and other articles of considerable weight may be fastened very securely with toggle bolts.

Light objects, such as pictures or mirrors, can be hung by means of hooks or "pushless" hangers. These may be used without reference to the studs behind the plaster. Drive the pins carefully to avoid chipping the plaster.

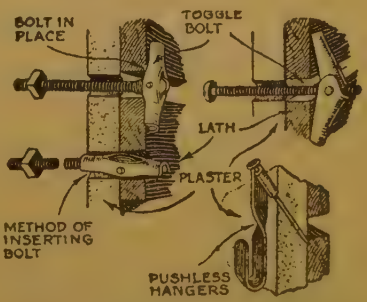


Fig. 17. Toggle bolts for use in hollow walls; a small wall hook.

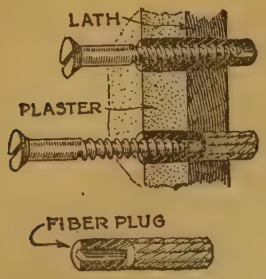


FIG. 18. Plug for use in plaster, tile, and stucco.

If wood screws are to be used, drive a 1½ in. long screw through the lath and plaster into the stud. Before driving the screw, drill a hole through the plaster of a diameter equal to its unthreaded shank.

Another method is to drill a hole in the plaster large enough to receive a prepared commercial fiber plug (see Fig. 18).

It is often possible to drive a 1¼-in. screw between studs so as to take good hold in a wooden lath. For light work, a hole can be drilled in the plaster a little larger than the screw and filled with patching plaster or plaster of Paris and water. Turn the screw gently into the soft filling and with a knife smooth down the plaster around the screw.

If it is desired to drill a hole into a brick, concrete, stucco, or tile wall, a stone drill of suitable size and a hammer—or a machinist's twist drill—may be used (see Fig. 19).

A hole may be jammed full of plastic wood putty and the screw turned in, or the wood paste can be allowed to harden first and then drilled to receive the screw.

PASTING LOOSENED WALL PAPER

Wall paper at times has a tendency to loosen from the plaster because of poor paste or lack of size on the wall. To remedy this condition, if the paper is not torn or cracked, puncture the paper at the top of each loose section, insert the tube of a small ear syringe, and inject as much paste as necessary (Fig. 20).

CONCEALING BLEMISHES AND REMOVING GREASE SPOTS

The easiest way to remedy a blemish is to paste a patch of the same paper over it, matching the

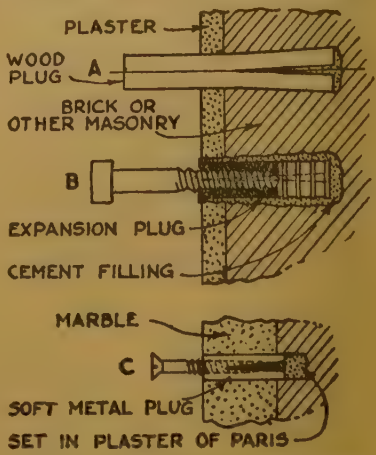


FIG. 19. Three types of wall plugs and how they are used.

paper carefully. To remove ink spots from papered walls, touch them lightly with water and apply a blotter; then treat them with oxalic acid. If the color of the paper is affected, it may be brought back with water colors or crayons.

FIG. 20. A method of pasting loosened wall paper.

A pencil and ink eraser will take off most spots from wall paper. Bear lightly on the eraser or the pattern will be rubbed off.

Commercial wall paper cleaners may be purchased and give excellent results. They are puttylike substances and may be used until they will take up no more dirt.

A wall paper cleaner may be made by mixing flour, 4 parts, and powdered sal ammoniac, 1 part (by weight). Knead them with enough water to make a puttylike mass.

Grease spots yield to a pad of blotting paper held by a moderately hot iron. After all the grease possible has been extracted in this way, finish the cleansing with pipe clay or fuller's earth as described in the last paragraph of this chapter. Repeated applications of benzine, allowing time for drying, will also remove grease spots. Another method is to cover a pad of cheesecloth with bran and rub the paper with this, replenishing the bran as it drops away.

Specially dirty spots, such as register the marks of children's fingers, may be gone over with fresh bread. Allow the bread to crumble away while rubbing, so that a clean surface will constantly be used against the paper.

Dampen finger marks with cold water and dust on a little powdered pipe clay or fuller's earth. After the powder has been on the paper for a few minutes, remove it with a soft brush.

CHAPTER IV

INSIDE PAINTING AND FLOOR FINISHING

FLOORS are scuffed and scraped as no other part of the house. The moment they are neglected, their scratched and dingy appearance becomes an eyesore. To keep them in good condition is not particularly difficult if you know just what to do; but to restore them after they have been allowed to get in extremely bad shape is, of course, a difficult job. However, as the appearance of the floors has so much to do with the attractiveness of a home, any necessary reconditioning is well worth while.

If your floor is of good material, such as edge grain pine, slash grain or quartered oak, maple, beech, or birch, but has been more or less neglected, the best and most economical procedure is to engage a contractor who has a motor-driven floor sanding machine.

If it is not expedient to machine surface a floor for financial or other reasons, the old finish may be removed with prepared paint and varnish remover. Do about ten boards at a time; then wash this strip clean with gasoline, turpentine, or denatured alcohol on burlap bagging to remove all traces of the paint remover.

When the floor has dried overnight, it should be sandpapered smooth. A weighted floor brush faced with No. 1 sandpaper is convenient, if available. Be sure to sand in straight lines parallel with the joints. If any spots remain, they may be sandpapered or bleached out with oxalic acid.

If the floor is of oak or other open-grained wood, the next process will be applying paste filler. For a natural finish, "natural" or transparent filler should be used; if a stained effect is desired, colored filler, which both stains and fills the pores in one operation.

Close-grained woods, such as maple, edge-grain pine, and similar woods, which do not require filling, are ordinarily colored with oil type stains where a stained effect instead of a natural finish is desired.

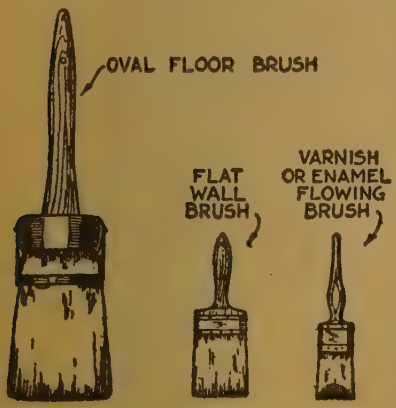
Finishes for Floors

The varnished finish is the first type to consider. The procedure is simple. Sandpaper the floor smooth;

be sure all dust and dirt are cleaned from the surface; apply three coats of high-grade floor varnish, sandpapering lightly between coats.

Three days is not too much to allow for drying.

There has been placed recently on the market, however, a new development known as "four-hour



Three of the most used types of brushes. Never buy poor brushes.

varnishes," which dry for use in about four hours. This new type is desirable where there are children in the family and it is difficult to keep them off the floors until ordinary varnish dries.

Shellac and wax make a beautiful finish when properly cared for, but one requiring constant looking after to keep it in first-class condition. The white shellac varnish should be thinned by adding from one half to three quarters as much alcohol. Do not apply more than two coats in an eight-hour day. The final coat should dry overnight so that waxing can be started the next morning.

Either the liquid or solid floor waxes can be applied. A large ball of wax can be inclosed in cloth and rubbed on the floor. Cover the entire floor before beginning to polish. The polishing may be done either with a weighted brush made for this work or with an electric polishing brush, which may be purchased or rented from the local hardware store.

On new work, it will pay to apply two coats of wax, polishing each coat and allowing about an hour between coats.

A shellacked finish is produced simply by the application of three coats of shellac instead of three coats of floor varnish, without waxing the final coat, as in the shellac and wax finish. Shellac, of course, dries very rapidly and gives a beautifully finished floor in a short time. However, where there is a great deal of wear on the floor, shellac is not so practical, as it is a more brittle type of finish than varnish.

In finishing new floors—either those in a new house or new hardwood floors which have been laid over old floors—the procedure is practically the same as described in the preceding pages for refinishing old floors, beginning at the point

where the old finish has been removed. It is assumed, of course, that the flooring has been properly scraped, sanded, and cleaned from stains and discolorations.

Painted Floors

A painted finish is by no means new. It has been in common use for soft wood floors since the days when all floors were either covered all over with carpet or matting, or else painted. However, within the last few years the vogue for painted floors from a decorative standpoint has grown in popularity, because of the possibilities they afford for harmonizing the floors with the walls and furnishings and because of the recent development of enamel-type finishes with a richer luster and greater hardness of surface than the old inside floor paints.

The application of floor enamel is, in itself, very simple. No filler is required, and no preparatory undercoat. All that is necessary is to be sure the surface is clean, dry, and perfectly smooth; sandpaper down any rough places and all rough edges.

Ordinarily, two coats will be sufficient, but where floors are subjected to a great deal of foot traffic, three coats should be used. All coats should be thinned according to the directions for the particular make of floor enamel used.

Where desired, the painted finish may be waxed, after the last coat has dried thoroughly, which gives a lustrous, soft-toned effect. Another treatment sometimes used is to rub the floor when dry with a cloth dampened with a mixture of equal parts linseed oil and turpentine; it is then polished with a woolen cloth, which imparts a soft, rich luster to the finish.

Care of Floors

Floors should be kept in good condition by proper daily care. This saves time and is economy in the end, as it avoids the necessity for laborious and expensive refinishing later on and prevents the spoiling of the fine finish through wrong methods of cleaning.

Varnished floors should be cleaned with a broom covered with a cotton flannel bag, or with a floor mop or a soft brush. Sweeping with a broom drags grit along the surface and scratches the finish. Go over the floor occasionally with a cloth or floor mop moistened (not saturated) with floor oil or kerosene. The oil in varnish finishes gradually dries out, and this occasional rubbing with an oiled cloth restores it and prevents the varnish from growing brittle.

The less water used on varnished floors the better. They should never be flooded with water, but if very dirty may be wiped with a cloth

or mop wrung out in warm soapy water; they should be dried at once and polished with an oiled cloth or mop.

Light scratches and white water spots can be generally polished out by rubbing with a cloth moistened with furniture polish, kerosene, or floor oil. When the finish of a varnished floor can no longer be restored by this method and the first signs of wear are apparent, a new coat of varnish should be applied.

Waxed floors must be given almost daily care to keep them always looking well. They should be cleaned with a soft brush or dry floor mop, free from oil (which softens the wax). Whenever more thorough cleaning is necessary, go over the floor with a cloth wrung out in warm soapy water or moistened (but not saturated) with gasoline or turpentine. After every cleaning, and at other regular intervals as may be desired, polish with a weighted floor brush or polisher, or by rubbing briskly with a soft cloth pad. Parts of the floor which receive the hardest wear should be given a thin coating of wax from time to time. The entire floor should be rewaxed occasionally after it has been cleaned. The waxer polishers which may now be rented at many hardware and paint stores are convenient and efficient for use about twice a year, which ordinarily is often enough for rewaxing.

Painted finishes should be brushed dust free with a soft brush, then gone over with a floor mop, either dry or dampened with floor oil. They may be wiped up when necessary with a damp cloth, wiped dry with a clean cloth, and then rubbed with an oiled cloth or floor mop.

Scrubbing with abrasive cleansers and strong soap or alkali preparations will quickly ruin any finish.

How to Look After Linoleum

Linoleum, one of the best and most practical floor coverings for kitchens and bathrooms and rapidly growing in popularity for sun rooms, halls, and other parts of the house, may be protected from wear by varnishing or waxing. This is particularly true of printed linoleums, the color of which does not extend clear through to the backing.

Printed linoleum should be varnished. Special linoleum varnishes are obtainable at most paint stores, but very pale, rather thin-bodied floor varnish may be used. It is important that the varnish be light in color; otherwise it will give light-colored parts of the pattern a yellowish cast. The condition of the linoleum should be carefully watched and revarnishing done before wear into the pattern commences to show.

Inlaid linoleum should be waxed. Varnish is not, as a rule, so satisfactory, as it has a tendency to crack where the breaks occur be-

tween the inlaid pattern segments, especially if the linoleum becomes bent. Either liquid or paste wax may be used; the liquid type is generally preferred and is easier to apply. It should be applied thin and only as often as necessary; when too much is used, it does not dry hard and becomes gummy.

Cement Floors

When painted, cement floors in basements and garages are smoother, have less tendency toward dustiness, are more impervious to water, and more attractive in appearance.

Satisfactory painting of cement or concrete surfaces can be done only when they are thoroughly dry and free from the active alkali which is always present in newly laid concrete. If the floor has been laid less than a year, it should be given a wash coat of zinc sulphate and water (in the proportion of 3 lbs. of zinc sulphate to 1 gal. water) to counteract the alkali.

Floors that are constantly wet through improper drainage should not be painted, as it cannot be done successfully. Special concrete floor finishes should be used for them.

The Walls of Your Home

The decoration of walls and ceilings has much to do with the success and beauty of a home interior. If in good taste and of appropriate colors, the walls of your home will tend to neutralize any defects in furniture and furnishings and render them less conspicuous. On the other hand, if the wall decoration is crude and inharmonious, it will emphasize other shortcomings of the decorative scheme.

During the days of our fathers and mothers, walls were painted only where ease of cleaning and length of service were of greater consideration than beauty. With the advent of flat wall finishes, which have a soft, velvety texture and a wide range of beautiful colors, painted walls came into vogue for their decorative value.

The Use of Flat Wall Paints

While it is ordinarily not a difficult matter to use flat wall paints on bare plaster walls which have never been previously painted, certain definite principles must be closely observed.

To start with, plaster walls are extremely porous and will absorb or suck in paint almost like blotting paper unless the surface is sealed and the suction stopped with a coating of wall size or special primer. The most common practice today is to mix a good grade of varnish wall size with the wall paint in proportions of about equal parts size and paint, or to use a special wall primer manufactured with the size already incorporated.

Ordinarily three coats are necessary for a good job of wall painting in plain color, especially with the light, delicate tones, although with the darker shades, or where a stipple treatment is to be applied, two coats often will be found sufficient. The second and third coats are generally applied as they come from the can, although the manufacturer's directions for all coats should always be carefully followed. Twenty-four hours should be allowed for drying between coats.

Wall painting should never be done over wall paper or kalsomine. The paper is likely to pull loose later from the weight of the paint and bring the finish along with it. The nature of kalsomine is such that it can seldom be painted over successfully; it must be washed off thoroughly.

Before the first coat of paint is applied, all cracks, digs, and other surface defects should be filled with prepared patching plaster, or some preparation such as plaster of Paris and paint (see 78). The patched places should be given a coating of size and allowed to dry for twenty-four hours before the painting of the entire surface is started.

When previously painted walls are to be refinished and the old finish is in good condition, all that is necessary is to be sure the surface is clean, dry, and free from grease. In the kitchen, where greasy deposits from cooking are always more or less present, it is advisable to clean the walls with a cloth saturated with benzine or gasoline. As the fumes are highly explosive, be sure there is no open flame in the room, not even a gas pilot light, and have plenty of ventilation.

The application of wall paint in itself is not difficult. A 3½- or 4-in. flat wall brush should be employed, and the paint applied with zigzag or crisscross strokes, which tend to make brush marks less noticeable than if the strokes are all the same way. Too much paint should not be used. The brush should not be dipped into the paint too far, especially when doing the ceiling; otherwise it will run down the handle and spatter. From one to two inches is sufficient.

If, after the first coat has been applied, there is a noticeable spotting of the surface, sometimes caused by extra porous spots in the plaster, it will be advisable to coat over the entire surface with the sizing mixture before applying the following coats, in order to keep them from sinking in the same spots; otherwise the spots are likely to show when the job is finished.

Enameling Plaster Walls

It is often desirable to enamel the walls of some rooms, such as the kitchen and bathrooms. Smoky, greasy deposits from cooking cling

much more readily to a dull, rough finish than to a smooth enameled one, and enameled surfaces are much more easily cleaned.

In enameling plaster walls, all cracks and imperfections should be filled, and if the walls have never been previously painted, the bare plaster given a sizing coat of about equal parts wall size and flat wall paint as when flat paint is to be used throughout.

When dry, this coat should be followed with a coat of half flat wall paint and half enamel, the flat paint being as nearly as possible the color of the enamel. The final finishing coat should be straight enamel.

Previously painted walls, if in good condition, can be done over in enamel by omitting the first sizing coat and applying simply the half-and-half coat of enamel and flat paint, and the final finishing coat of enamel.

Sponge Stippled Walls

A form of wall decoration now much in vogue is sponge stippling. This is done by applying a background coating of flat wall paint of the desired color, over which one or more stipple color coats are applied with a sponge. The secret of success lies in a harmonious combination of colors, together with a few important details of mechanical execution.

Either the foundation coating can be in a rather bright color and a stipple pattern applied over it in a neutral color to tone down the background, or a neutral color may be used to start with and the bright color woven in with the stippling sponge. The whole effect resembles tapestry or brocaded satin, while actually the wall is

In sponge stippling, the flat face of the sponge is patted firmly on the wall without twisting.

smooth and easy to wash and clean.

The foundation or background coating is first applied to the wall —two coats of regular flat wall paint of the desired color, brushed on in the regular way. The first coat should be mixed with an equal part of a varnish mixing size, to seal the very porous plaster and keep the paint from sinking in, as previously explained.

The ceiling should be done at the same time—three coats, as ceilings are always left in plain color (not stippled with the side walls) and are ordinarily in ivory white or some very light tone requiring three coats for a good job.

When the foundation coating of the walls is dry, you are ready for the stippling. As previously indi-

cated, the pattern of the sponge is printed onto the background color. In selecting the sponge, an expensive one is not necessary, but one with an interesting pattern, having well-defined open spaces of a delicate, lacy nature. The bottom of the sponge is trimmed or sliced off to get a perfectly flat printing surface. This may be done by soaking the sponge in warm water and trimming with a pair of shears, or by cutting the sponge with a large knife when dry. This is one of the secrets of sponge stippling, as unless the printing surface is perfectly flat, only the high spots will print. When ready to start stippling, the sponge is wet in water to soften it, and wrung out moderately dry.

After going around the entire room with the first color, apply the second stipple color in the same way. A two-color stipple always looks much more attractive than one color, and it is easier to do well, as the second stipple tends to cover up imperfections in the first stipple coat. A small piece cut from the back of the sponge may be used to do the corners and edges next to the woodwork.

The sponge should be thoroughly rinsed in gasoline, followed by a soap and water washing, immediately after finishing each stipple coat. If done at once, there is no difficulty in washing it out just as clean as before starting.

The stipple color is regular flat wall paint; a little varnish may be added if desired, which will give the stipple color a delightful sheen when dry and greatly improve the effect. A little of the mixture is poured out on a piece of tin or folded paper. The sponge is then rubbed into it and tapped a few times on a piece of clean paper to remove any excess paint. The stippling then is started by patting the sponge straight onto the wall, without turning or twisting, and with a firm but not too heavy stroke. After about every dozen strokes the sponge should be reloaded. Another secret of stippling is to have the right amount of paint on the sponge. Too much will produce a heavy, dauby print, and too little will make weak, uneven prints. Avoid placing the sponge prints in straight lines—stagger the prints as you go along, being careful that each print comes closely up to the one next to it, but not overlapping.

A little practice work should be done by the amateur on sheets of manila paper. It is also well, at all times, to start back of a door or some other less conspicuous surface so you can be sure everything is running along right when you get to the more conspicuous parts.

Mottled or "Tiffany" Finish

While not so easy to do well as sponge stippling, "Tiffany" or mottled wall finishes have been success-

fully done by a great many amateur decorators.

This type of decoration is produced by applying a foundation of flat wall paint, over which is stippled or mottled a coat of "glaze colors." These are transparent oil colors of great clearness and brilliance, which permit the underbody color of the flat foundation coats to show through to a considerable extent, producing a rich, luminous depth of color. The stippling is usually done with a cloth but sometimes with a crumpled newspaper.

The procedure for the foundation or background coating is exactly the same as that described in the preceding section on sponge stippling, and the suggestions pertaining to ceilings also apply here.

Suitable color combinations are absolutely essential for successful "Tiffany" decoration, and, unless one is an artist, it is advisable to follow one of the specific suggestions which are generally given in the flat wall paint color cards of most manufacturers.

As soon as the foundation coat is thoroughly dry, the mottling may be started. A little oil color of the desired shade is squeezed from a small tube into a receptacle of "glazing liquid," a preparation sold for the purpose by nearly all first-class paint stores. Proportions should be experimented with until just the desired effect is obtained. In another container a little of the other mottling color called for in the specifications also should be mixed with the glazing liquid to the desired tone, as practically all mottled effects call for two or more stippled colors.

In starting the stippling, the first step is to prime the undercoated wall with a thin coat of clear glazing liquid. Do about a yard and a half width of wall at a time, from ceiling to floor. The tinting liquids then should be brushed on generously.

The two stippling colors should be applied simultaneously, using a different brush for each color. One color should always predominate, being applied to a larger area, and the other color should be spotted in at intervals and in varying sized spots. In applying, the colors should be run together somewhat and blended with the brush so that one color will go into the other softly.

The stippling is done with a cloth, crumpled and held loosely in the hand and constantly changed to present a clean surface of the cloth to the paint.

The texture of the effect in work of this kind is governed by the cloth used. Soft old gingham is usually desirable, while cheesecloth is generally undesirable as it does not have sufficient body. With some effects, where a coarse texture is preferred, burlap is used. Crumpled newspaper is also sometimes used. By a twisting and lifting motion,

Mottling or stippling the color with a clean, crumpled cloth, in producing "Tiffany" effects.

beautiful scrolls are produced. By twisting the hand without any side motion, a rosette or flowerlike effect is obtained, while a sweeping side movement produces a more branching pattern. A few experiments on a piece of wall board or even on heavy wrapping paper will reveal the many possibilities.

Stencil Borders

The appearance of painted walls may be greatly enriched with stencil borders of distinction.

Stenciling is really very simple. In fact, to anyone who has never done this work, it is inconceivable that anything which adds so much to the appearance of a room can be accomplished so simply.

Stencils in a great variety of designs may be purchased at nearly all paint stores. They are usually made with a guide hole at each end —or the little cut-outs at the extreme ends of the pattern are exact duplicates. When one section of the design has been stenciled on the wall, the stencil is moved along so that the guide hole at the left end of stencil fits right over the stenciled spot on the wall at the extreme right of the pattern. The stencil is moved along length after length and always joins perfectly.

All of one color is done around the room. Then, on a two-color design, the other part of the stencil is used, and the second color put in clear around the room. Some stencils are in more than two colors, and the same principle is used in getting the correct register.

Stenciling is done with a regular stencil brush sold for the purpose by all paint stores. The stencil is placed against the wall, care being taken to have it parallel with the ceiling. This may be regulated by cutting off the top of the stencil so that the top edge will follow the ceiling or the picture molding.

In some instances, as in bathroom or kitchen, the stencil is placed just above the wainscoting or chair rail, in which case the bottom of the stencil would have to be trimmed to be parallel with the guide line it must follow.

The brush is dipped into the color, a little of which has been poured onto a plate, and then is pounced on the wall with a rotary motion, being held at right angles to the wall.

Either opaque or transparent colors may be used. The soft tinted effects are better accomplished with the transparent material, while the opaque materials must be used

where the border design is to be lighter than the background. Otherwise, it is largely a matter of individual preference and the particular effect desired.

Regular stencil colors are sold in tubes by most stores, these generally being of the transparent type (easily changed to opaque by the addition of flat wall paint). Regular flat wall paint in colors, or in white tinted with oil colors to the desired shade, are often used where opaque material is desired.

For thinning stencil colors to the desired consistency, turpentine may be used, but the "glazing liquid" which is used for glazed or stippled (Tiffany) effects is preferable. When used, it will be found that the paint does not pile up so much on the stencil, and also that the color will dry with a slight sheen, which is very pleasing.

Do not, however, have the color too thin, so it will run under the stencil, and always apply it with scant brushfuls. Another thing that must be done is to wipe the side that goes against the wall after each setting, so that any color which gets over on the back of the stencil will not smudge the wall at the next setting. The stencil should be laid face down on a piece of paper and wiped off with a cloth, preferably moistened with gasoline or turpentine. Care is necessary or the cloth may catch and tear the stencil.

A few thumb tacks may be used to hold the stencil in place, if desired, especially until one becomes accustomed to using it. They will not injure the wall in the least if put in lightly and carefully withdrawn.

The stenciling should be started in the least conspicuous corner, and kept on around the room. With most stencil designs, the stencil may be bent to fit into the corners, always being careful not to break any of the delicate cut-out work.

Frequently it is desirable to have the pattern come out even at a certain point. In this event, when you are about five or six lengths away from this point, find out what the discrepancy, if any, will be. Divide the odd space by the number of lengths remaining, and then "steal" the necessary distance each length, extending the stencil or crowding it as required. Care should be taken, of course, to have all of the corners look properly balanced.

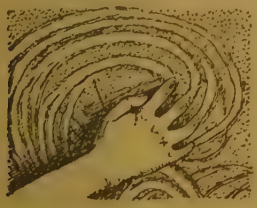
Stencil borders will add much to the appearance of any room decorated with flat wall paint, in either plain color, sponge stippled, or "Tiffany" treatment, provided the designs and colors are appropriate. This is not difficult, however; it is largely a matter of good taste, the same as choosing becoming colors and patterns in dress goods, drapes, and the like. The size of the border should correspond

to the proportions of the room, and, generally speaking, brighter colors may be used in smaller designs than in the larger ones.

Plastic Paint Decoration

Another form of wall treatment is the comparatively new plastic wall finishes.

Prepared materials in powder form are on the market under various trade names, and flat wall paints and white lead-in-oil also are sometimes mixed with stiffeners such



In plaster wall decoration, striking effects can be produced with the fingers alone.

as plaster of Paris or whiting to a doughlike or plaster consistency. It is not advisable, however, for the amateur to try to mix his own material, as the proportions must be properly balanced in accordance with the kind of paint used; otherwise the finish is likely to crack after it hardens and sets.

Plastic paint is applied with a brush (to a comparatively small stretch of surface at a time) and, before it commences to set, is either stippled or modeled into swirls and fanciful designs with an ordinary kitchen spoon, table knife, coarse brush, or similar implements.

With some makes of plastic paint it is necessary to coat over the plaster walls with a special sizing preparation recommended by the manufacturers; with other makes this is not necessary.

After the modeling is completed and the finish has hardened thoroughly, the nibs and rough places should be smoothed off, this generally being done by shoving a straight-edged board back and forth over the surface or by sandpapering with coarse sandpaper over a block.

This done, the finish is ready for the color treatment. The usual method is by brushing on a coat of glaze or of oil colors reduced with a special glazing liquid which does not set up as quickly as turpentine; or by dusting on bronze powders of several harmonizing shades, such as gold, copper, and green. Then, immediately, parts of the coloring are wiped from the high places as desired, to give a polychrome effect.

Ceilings may be finished with regular flat wall paint or with kalsomine in ivory white, cream, or other light tones corresponding with the coloring used in the wall treatment. They are also sometimes done in a brush texture of the plastic paint, without the relief modeling. In some cases flat wall paint stiffened slightly with plaster of

Paris or whiting is used, and pebble stippled with a regular stippling brush.

The possibilities for artistic wall decoration with plastic finishes are practically unlimited, as an almost endless variety of textures and colorings may be worked out, according to the fancy of the decorator. There are also certain accepted forms of texture, following the lines of Spanish, Italian, English, and other architecture and old Greek and Roman craftsmanship, complete directions for which often can be obtained from the manufacturers of plastic finishes.

Kalsomine—When and How to Apply It

Kalsomine may be the most suitable finish for the walls and ceilings of your home, or perhaps for the ceilings alone.

Plain white plaster walls in a new house are not inviting, yet it is known that to paint new plaster immediately is risky because of so-called "hot spots," which are apt to fade oil colors and burn the life out of the oil or varnish binder, causing dead, flat looking blotches. Furthermore, new plaster is expected to settle and probably crack in places during the first winter. For these reasons it is desirable to decorate the walls and ceilings in the least expensive manner, and kalsomine serves well.

Kalsomine is to be recommended, too, when a frequent change of color is wanted, and also when it is desirable to get the decoration done in the quickest possible time. Kalsomine gives artistic, plain, absolutely flat or pastel coloring and merits consideration for that reason, aside from its inexpensive character.

On the other side of the account we should consider the limitations. While good kalsomine today does not rub off like whitewash and as kalsomine did years ago, it is not washable. It is applied in one coat over a size coat on either new or old walls, but it must be washed off before redecorating with kalsomine, with paint, with wall paper or wall fabrics, or with lacquer. While you save something in the first place by decorating with kalsomine, a part of what you save will have to be paid when redecorating later on.

Prepared kalsomine is sold in a variety of tints and shades. In a majority of cases the desired color can be selected from the color card; all you have to do is to add the water and mix the material. When some unusual tint is needed, buy one of the available tints that is very near to what you want and then add to it a little of one of the other colors on the color card to give the exact tint desired.

New plaster of the smooth type to be kalsomined calls for little preparation aside from sizing. Sand-finish plaster, if new, requires to be

swept down with a broom to remove loose sand. Old walls having kalsomine on them must be washed before rekalsomining.

If old kalsomined walls have had a varnish or gloss oil size on them, that size will not be removed by the washing and it will not be necessary to size again before applying the new kalsomine. Gloss oil size serves well enough for kalsomine, but it is decidedly out of favor, because later on it may be desirable to use paint, wall paper, or wall fabric, and none of these decorations adhere well to this kind of size.

Kalsomine on a sand-finish wall cannot be removed completely, but the new size coat binds in place what kalsomine is left in the low pores of the plaster. A stiff brush aids in washing off the kalsomine from a rough surface.

Kalsomine can be applied over painted walls. If the paint is dead flat, simply plaster like new plaster; if it has some gloss, wash it down with hot water and a washing powder or sal soda to cut the surface a bit and then size it.

Various sizes are suitable for kalsomine finishes, but glue size is most commonly used. It is made by soaking flake sizing glue—say a pound—in a little cold water overnight. In the morning add one pail of hot water and stir the glue until dissolved or work it with your fingers. Varnish size may be obtained at most paint stores.

Follow the directions on the package in mixing kalsomine. They may call for hot water or for cold. It is in the brushing that amateurs are most likely to get into trouble with kalsomine. This is because they are likely to try to brush it out, to stretch it out, like oil paint. A good kalsomine brush of the standard type or of the Dutch type is necessary, and it must be dry when you start to use it. A wet brush is too soft and flabby to work well.

Kalsomine should be flowed on freely and brushed as little as possible. Flow it on evenly, keeping the brush well filled. As a rule only one coat is applied. A skillful brush hand can often "topover," as it is called, with a thinner second coat, but this is difficult to do successfully, and the application of one coat over another should not be attempted by the amateur.

The Woodwork of Your Home

Beauty, good taste, and modern treatment are the chief characteristics desired in the finishing of interior woodwork, where the finish is not subjected to the grinding wear of floors or the ravages of severe outside exposure.

The two types of finishes most popular at present for interior trim are enamel finishes and stain finishes, although a natural varnish finish is also used quite extensively, particularly with beautiful woods.

Enamel Finishes

Enamel finishing affords an opportunity to modernize and greatly improve the appearance of a room by changing old woodwork from out-of-date effects to one of the more popular finishes.

Old woodwork can be refinished ordinarily without taking off the old finish, if done in the right way. The first step is to sandpaper the old finish to cut the gloss and provide a "tooth" for the new finish to adhere to. Four coats should then be applied, as follows:

First Coat. Enamel undercoater, to which a little varnish has been added to help the new coating adhere closely to the old varnish finish, so it will not chip off later on. Regular enamel undercoaters are sold at all paint stores, usually in white only. Flat wall paint also makes a good enamel undercoater and has the advantage for the novice that it may be obtained in colors closely approximating the color of the finishing coat, thus being more easily covered by the following coats.

Second Coat. Another coat of flat undercoater, without the addition of any varnish.

Third Coat. A mixture of equal parts enamel and flat undercoater.

Fourth Coat. Straight enamel.

Each coat should be allowed at least forty-eight hours for drying, and all coats except the final finishing coat should be sandpapered with No. 00 or finer paper. Dust the surface clean before proceeding.

After the first coat has dried, any digs or other surface imperfections and any unsightly cracks between the woodwork and the wall should be filled with a crack-filling preparation. Some of the first coat mixture to which a little plaster of Paris or whiting has been added to stiffen it into a dough is satisfactory and economical for the purpose. Where used on conspicuous surfaces, this filler should be smoothed off as much as possible when applying, and sandpapered perfectly level with the surface when dry.

While it is sometimes possible for a skillful brush hand to do a good three-coat of enameling, where all the conditions are ideal, it is seldom that a thoroughly satisfactory finish can be produced with less than four coats. The sharp edges, which are harder to cover than flat surfaces, and any places where the material may have been brushed out too thin will show through as an objectionable blue color unless sufficient coats are applied to build up a perfect finish.

If a dull effect is desired instead of a full enamel luster, the final coat may be rubbed with pumice stone and oil to a semidull surface, as explained in detail in the section on varnish finishing. Or, if desired,

a dull drying enamel may be used for the finishing coats, although this does not produce quite the depth and richness of finish that a hand rubbed job does.

For new woodwork the process of enameling is practically the same as for refinishing old surfaces, except that instead of varnish a little turpentine is added to the first coat to help the material penetrate into the bare wood and thus provide firm anchorage.

How to Brush Enamel

Enamel should be flowed on in a full coat and not brushed out as one would apply paint. Expert painters often follow the practice of flowing on the enamel with the grain; next "crossing over," as they call it, and brushing across the grain without refilling the brush; then "straightening out" the surface again by brushing with the grain. This method can be satisfactorily employed by the novice; however, as too much brushing does more harm than good and enamel must not be brushed into after it has commenced to set up, the amateur often finds it better to flow on the enamel and let it alone. It will quickly level itself out to a very satisfactory surface, free from brush marks, of its own accord.

The principal defects in workmanship to be avoided are sags and drips of enamel at the corners or "curtains" of enamel running down in an irregular formation on upright surfaces. All these are caused by applying an excess of enamel. Be on the constant watch for these defects. When sags are seen, pick them up with a corner of the brush; where "curtains" begin forming, smooth them out by brushing deftly over the surface, wetting the brush with some fresh enamel or turpentine, if necessary, and taking up some of the excess enamel with the brush. Another important thing is to have the surface free from dust and to be sure that no dust is raised in the room to settle in the finish before it has dried.

Varnishing Old Woodwork

Many times revarnishing is all that is necessary to restore interior woodwork to its original condition and bring back its life.

One of the important things in revarnishing old woodwork is a thorough scrubbing of the surface, as any dirt that may be varnished under is there to stay and will disfigure the finish permanently. The addition of a little sal soda to the cleaning water is a good thing, as it deadens the gloss of the previous finish a little so that the new coating will adhere more closely. A light sandpapering then should be given the surface, after which it should be dusted free from loose particles of sand.

Nothing further is ordinarily necessary before the application of the varnish. A high grade of interior finishing varnish should be used. One coat is generally sufficient for refinishing work of this character where the previous finish is in good condition.

In varnishing, particular care must be taken to see that the brush, the surface, and the varnish are all free from dust, as dirt specks showing through the varnish are magnified and very unsightly. If there is any dirt in the varnish, it should be strained out through cheesecloth. Care also should be taken that no dust is raised in the room while applying varnish or before it has dried dust free. The surface and the varnish should be reasonably warm, as varnish does not flow out well when cold. In case varnish has been standing in a cold place, it should be warmed by placing the container in a pan of warm water.

For the finest workmanship, the varnish should be applied with the grain; then brushed across the grain without refilling the brush, then finally straightened out by brushing with the grain again, as previously explained in connection with enamel finishing.

Dull Finish Varnish

Woodwork finished in gloss varnish may be changed to the popular semidull finish. if the old surface is in good condition, by the application of a dull or flat drying varnish. Only one coat is necessary; the surface, of course, should be thoroughly clean. Flat varnish should be flowed on and let alone with no crossing over and straightening out as is often done in the application of gloss varnishes. Dull drying varnishes must not be brushed out. The container, also, should be shaken vigorously immediately before using, as part of the content of this type of varnishes usually settles to the bottom after standing for a time.

In building up a semidull finish on new woodwork, the procedure is generally as follows:

First, the application of stain coat (unless the wood is to be left natural); second, filling the wood, if of an open grain type; third, the application of a thin shellac coat, if the wood has been stained, to seal in the stain and keep it from bleeding through the following varnish coats; fourth, the application of one coat of gloss varnish; and last, the application of one coat of flat drying varnish. A finish built up in this way will be permanently beautiful, and will stand washing, cleaning, and general hard usage.

The most beautiful semidull finishes are, of course, produced by hand rubbing; such finishes have a depth and richness which cannot be fully attained with dull drying varnishes.

Rubbing is done in the following manner, after the final finishing coat of gloss varnish has been applied and allowed to dry for at least three or four days, or preferably for a week.

Place some powdered pumice stone (FF grade or finer) in a saucer or shallow receptacle. In another similar receptacle place a little rubbing oil (or good sewing machine oil). The rubbing is done with a piece of regular rubbing felt, which can be obtained at the larger paint stores, or with a soft cloth folded into a pad. Dip the pad first into the oil, then into the pumice, and rub over the surface with long, even strokes, and a very light pressure. Only a few strokes should be used; it is very easy to cut through the finish. To determine whether you have rubbed sufficiently, wet your finger in water and clean a little of the surface from the pumice accumulation in order to see if you have attained the desired effect.

When the surface is smooth and perfect, clean it thoroughly with a soft cloth and clean water, then wipe it dry with a chamois or soft cloth.

Another method of rubbing, which is simpler for the novice to use and is not likely to result in cutting through the varnish, is to go over the surface with a piece of fine steel wool (No. 00 or finer) wet with just enough linseed oil to take off the glare of the gloss varnish and polish off any projecting nibs or dirt specks.

Enamel finishes, as well as varnish, may be rubbed by either of these methods.

Varnish-Stain Method of Finishing Old Woodwork

It is often desired to change old woodwork to some other effect, as, for instance, from a natural or golden oak finish to the now popular walnut or brown mahogany finish.

This can be accomplished without removing the old finish, providing the new effect desired is darker than the old finish, through the use of varnish-stain (stain and varnish combined), which can be obtained ready for use in the popular hardwood finishes, such as walnut, mahogany, and light and dark oak.

Sometimes the old finish is in such bad condition that it cannot be refinished satisfactorily through the application of a coat of clear varnish, yet it is not desired to go to the expense of removing the old finish and building up a new one from the bare wood. In this event, also, a varnish-stain finish offers the most satisfactory treatment.

Where the old finish is in reasonably good condition and is to be refinished in one of the dark effects, the only preparation necessary is to sandpaper the old finish to cut the gloss. Then apply one coat of

high-grade varnish-stain of the desired color. This may be followed with a coat of flat drying varnish, if desired, to produce the popular semidull finish.

In case the old finish is in extremely bad condition, it is sometimes necessary to apply a coat of "ground color" before the varnish stain is applied. It should be remembered, however, that this hides the grain of the wood, and some of the natural beauty of the finish will be missing. Graining, of course, can be done with a little practice through the use of a special graining tool or by manipulation of the brush.

Removing Old Paint and Varnish

In some cases where the condition of the old finish is too bad for satisfactory refinishing, it may be necessary to remove the old coatings. Sometimes, also, certain desired effects can be produced only by taking off the old finish and starting from the bare wood.

The best method of removing old finishes is through the use of a prepared paint and varnish remover, which is efficient but will not burn, discolor, or raise the grain of the wood, as do lye and strong alkali preparations.

Cover the surface with a liberal coat of the remover, applied with an ordinary paint brush. Allow it to stand a few minutes until the old finish has become softened; then scrape off the finish with a putty knife, taking care not to dig or gouge the surface. For moldings, beading, and the like, apply in the usual way, and when the finish has softened, scrub out with a small vegetable brush instead of scraping. In case the old finish is not entirely removed with one application, a second treatment with the remover may be necessary.

After the old finish has been entirely taken off, the surface should be washed thoroughly with a cloth soaked in gasoline, turpentine, or benzine, to remove every trace of the remover itself. *This is important,* as any remaining deposits of the paint remover will prevent the drying of following finishing coats.

The Use of Paste Fillers

All new open grain woods, including oak, walnut, mahogany, and chestnut, require the use of a paste filler to fill the pores and level the surface for the finishing coats of varnish. Close grain woods, which include maple, pine, poplar, gumwood, redwood, and beech, do not require the use of a filler. Birch may be classed either as an open or a close grained wood. It does not absolutely require filling, but the use of a filler will bring out the natural beauty of the wood and enrich the finish.

Paste fillers come in heavy paste

form and are reduced with benzine or turpentine to about the consistency of thick cream immediately before use. They are made in several colors—transparent, or what is called "natural," and in various popular hardwood effects. The natural, of course, is always used with natural finishes, and the colored fillers are chosen in accordance with the effect being produced. Fillers alone are sometimes depended upon for coloring the wood, and certain effects can be obtained only in this way; however, in the majority of cases this is done for reasons of economy only, to save a coat of stain which, if applied, would produce a richer finish.

The filler is brushed on and allowed to stand until it begins to flat out or lose its gloss; then it is wiped with a piece of cloth or burlap across the grain in such a way as to pack the filler into the grain of the wood. It is important that the filler be wiped off from the surface absolutely clean, as any residue will discolor it.

Finishing New Woodwork

A stain and varnish finish and a natural varnish finish are two types of finish that can be produced best on new wood or by removing old coatings and building up the new finish from the bare wood. In this connection, it should be remembered that while old coatings of enamel, varnish, or paint can be removed thoroughly from the surface of the wood by the use of a paint remover, stain finishes which have penetrated deeply into the wood cannot be removed to permit refinishing in a natural effect.

Stain and Varnish Finish. On new woodwork or on that from which the old finish has been completely removed, the stain and varnish finish is produced by first coloring the wood with a stain and then applying finish-coats of clear varnish. It will be noted that this is different from the varnish-stain method previously described, which stains and varnishes at one operation—a quicker method, but one which does not produce as fine a finish as the one now being described.

The first step is to apply the stain—one coat. There are two types of stain which are especially adapted for use by the amateur—penetrating stains and oil stains.

Penetrating stains may be used on new hardwoods or on previously finished woods, either hard or soft, but are not as satisfactory for soft, porous woods, as they penetrate too deeply and quickly.

Oil stains cannot be used on previously finished surfaces from which the old finish has been taken off, as it is impossible to remove old coatings sufficiently from the pores of the wood, but they may be used with a reasonable degree of satisfaction on new hardwoods. They are

especially suited for new softwoods.

In brief, the method of building up a stain and varnish finish on new wood or wood from which the old finish has been removed is as follows:

First, apply one coat of stain. Second, if one of the open-grained woods is being finished, apply a coat of paste filler (see page 112); this is not necessary with close-grained woods. Third, apply one thin coat of shellac—orange on the darker effects, such as walnut and brown mahogany; white shellac on the lighter effects. For this purpose ordinary shellac varnish can be thinned with at least an equal amount of denatured alcohol. This is to keep the stain from bleeding through the following finishing coats. Fourth, apply two coats of gloss varnish.

Oil stain is usually wiped off within a few minutes after being applied, as there is generally an excess of stain that does not soak into the wood. Some variation in the effect is possible through light or heavy wiping.

The varnish finishing coats should be allowed fully forty-eight hours for drying, and more if possible. The shellac coat will dry in about two hours. Both shellac and varnish coats should be sandpapered lightly with fine sandpaper when thoroughly dry, but the stain coat ordinarily should not be sandpapered, as this is likely to cut into the color and produce an uneven appearance.

If desired, the final coat of gloss varnish may be rubbed with pumice stone and oil, or with steel wool wet with linseed oil, as previously described 111, or a coat of flat drying varnish may be applied.

Natural Varnished Finish. This is produced in the same way as the stain and varnish finish just described, except that the stain coat and the subsequent sealing coat of shellac are not employed. In other words, the wood is filled, if necessary, with natural or transparent filler; then two, or preferably three, coats of varnish are applied.

Miscellaneous Inside Painting

There are many surfaces that can be refinished so as greatly to improve their appearance and make the house more modern, as well as lighter, more sanitary, and more easily taken care of. Following are a few suggestions which will indicate the possibilities in this direction in every home.

Clothes closets are often dark and unattractive. They can be made attractive, light, sanitary, and convenient to use by enameling the walls white and hanging an electric light from the center of the ceiling, to be operated with a pull chain or automatically by a door switch.

Wall brackets and other fixtures can be harmonized with the deco-

This painting kit, with compartments and hooks, keeps all the materials handy and easily accessible. The handle on top makes it easy to carry from place to place, and hanging plates on the back allow it to be hung out of the way.

ration of a room by enameling them in appropriate colors. If the woodwork, for instance, is in ivory enamel, wall brackets may be done over in ivory enamel, with a dash of color on edges, knobs, or beadings to match tones in the wall paper or wall paint. Hanging fixtures, as well as brackets and other ornamental metal work, often can be attractively refinished in gold or aluminum bronze.

Radiators may be finished to correspond with wall decorations through the use of flat wall paint. If, however, an enamel finish is desired to match near-by woodwork, high-grade enamels such as are used on wood surfaces may be used, provided all rust is scraped and sandpapered off. Aluminum and gold bronze also are used extensively for the finishing of radiators; but they tend to retard the radiation of heat, according to tests made by heating experts.

Water pipes and tanks may be finished with aluminum or gold, although flat wall paint is often desirable to go with a decorative scheme. *New* galvanized iron should be wiped over with vinegar immediately before being painted in order to cut the greasy deposits always present on new galvanized iron or tin; then it should be primed with a special galvanized iron primer. Old galvanized iron surfaces, however, are usually free from oily deposits and do not require this preparatory treatment or the use of a special primer. In all metal painting, nevertheless, it is always best to use either red lead and oil or a special rust inhibitive metal paint for the first coat.

Stovepipes should be refinished with special stovepipe enamel, made for use on surfaces subjected to heat. It should be applied when the surface is slightly warm and allowed to dry for at least twenty-four hours before using; then, it should be warmed up slowly.

Furnace pipes of the ordinary type (tin plate) may be advantageously painted with aluminum paint, which helps to retard the passage of heat out through the walls of the pipe into the basement. This should be applied only to the pipes which lead to hot air registers. The pipe leading to the chimney may well be

left unpainted, as all heat passing out into the basement from it helps to warm the house instead of going up the chimney.

Cold Water Paint for Basements

A type of paint which is not so well known as it should be, or about which many have a wrong conception, is cold water paint. It is ideal for painting ordinary basement walls.

Cold water paint is not kalsomine, although it comes in dry powder form to be mixed for use with water, the same as kalsomine. Kalsomine is not well suited for use on basement walls that are subjected to the slightest dampness or moisture, such as the splashing of water when laundering is being done or the floor is being cleaned. It is made with a glue binder, and when it gets wet it runs. Cold water paint, on the other hand, is made with a special type of binder which has the property of absorbing and taking up water and giving it off again, so that when wet it dries out to its original condition without running and discoloration. It is almost as durable as oil paint and by far the most economical material to use for this purpose.

Cold water paint ordinarily is obtainable in white only, but may be tinted to any desired shade with dry colors by mixing the color with a little water until thoroughly dissolved, then pouring it into the previously made mixture of cold water paint and water; this prevents any tendency toward streaking from undissolved particles of color.

Painting Wall Board

Wall board of all the well-known standard types, now so generally used for many purposes about the house, such as adding a room to the attic and making basement partitions, may be painted with flat wall paints or enameled. The procedure is practically the same as for bare plaster walls. However, some boards are very porous.

It is of the utmost importance, therefore, that they be thoroughly sealed before applying the finishing materials. When flat wall paint decoration is used, one coat of sizing is usually sufficient; however, instead of using about equal parts of wall size and flat wall paint as is the usual practice for bare plaster walls, a mixture of about three fourths size and one fourth flat wall paint should be used. Where the surface is to be enameled, the best practice usually is to seal the surface with a coat of shellac before applying the flat undercoater.

CHAPTER V

PAINT DRESSES UP A HOUSE

EVERY home owner should know something about exterior painting. Many who have the time and the liking for outdoor work paint their own houses, and there are also many jobs the handy man can do, even though he does not attempt the whole house.

The first thing to fix in mind about painting is that there is more to it than simply dipping a brush into a bucket of paint and brushing it over the surface. As a matter of fact only a reasonable amount of care is needed to brush on the material, but there are some half dozen other factors which have a great deal to do with good results. These are: Proper condition of the surface; right weather conditions; the right material, properly thinned for each coat, according to the particular requirements of the surface on which it is to be used; thorough mixing or stirring of the paint immediately before and occasionally while using; the use of good brushes of the right kind; and sufficient drying time between coats.

If these factors are right and the paint is brushed on with ordinary care, satisfactory results will be practically assured; otherwise painting is a haphazard proposition—sometimes turning out well, sometimes not. We will take up each of these factors in detail.

First and foremost, the surface must be thoroughly dry. This cannot be stressed too strongly, as moisture is probably the cause of more painting troubles than all other causes combined. New buildings should not be painted before plaster or wet basements have dried out, as the moisture is apt to force its way through the siding and blister the paint, even though the siding was thoroughly seasoned when put on.

Painting also should be avoided while fresh mortar beds are in close proximity, on account of the tendency of the oil in the paint to absorb the moisture and fumes from the lime.

Preparing the Surface

A clean surface is also important, as dust and dirt will mix in with the paint and discolor it. Be sure

to brush off dust over doors and on window ledges. Particular care also should be taken to scrape off any mud that may be caked on the wood, as it is likely to pull loose later on, taking the paint with it. In case any grease or oil has been spilled or spattered on the surface, it should be scrubbed out with soap and hot water, followed by a cleaning with high-test gasoline or turpentine and steel wool. All rough places should be smoothed down with sandpaper.

In repainting, any loose or peeling paint should be removed with a scraper, broad putty knife, or wire brush. Be sure to break any blisters and scrape the paint off as far back as it is loose.

On new work, all knots and pitchy, resinous places should be sealed over with a brush coat of orange shellac shortly before the application of the first coat of paint, to prevent the pitch coming through the paint later. It also tends to keep the knots from dropping out.

Nail holes and cracks should be filled with pure linseed oil putty. On new work this should be done *after* the priming coat has been applied and has had time to dry thoroughly; otherwise the oil from the putty will soak into the bare wood and cause the putty to crumble and drop out. Do not apply the following coat of paint until the putty has set.

Where sections of the surface have blistered and peeled very badly, it may be necessary to burn off the old coating with a painter's torch. This should be done only by a painter who understands the use of a blowtorch; otherwise there is great risk of a fire.

Proper Weather Conditions

Outside painting should be done under favorable weather conditions. Never paint during or following a rain, heavy dew or frost, in damp, foggy atmosphere, or when rain is threatening. Neither attempt it in freezing weather. If the surface is cold, the paint may crawl and sag. If the paint freezes before drying, the appearance of the job is ruined, and it is not very satisfactory even if painted over.

Painting under the direct rays of the summer sun also should be avoided as it may cause blistering. Generally painting can be done so as to "follow the shade" around a house.

Spring is more popular than any other time of year for painting. However, spring painting should never be done (except in the warmer climates) until there has been sufficient dry, warm weather to overcome the effects of winter rain, ice, and snow. Fall is always a good time to paint, as generally there are few rains and the lumber is in good condition.

Seasons of the year when bugs,

gnats, flies, and insects are prevalent are not desirable for painting, as they stick in the paint more or less and spoil its appearance, although certain substances, such as oil of citronella, can be added to the paint to keep insects away.

"How Much Paint Shall I Need?"

No set method of estimating can be absolutely correct in determining in advance how much paint will be used, as allowances must be made for bays, gables, and irregularities of design in many houses, as well as for a difference in the amount of material absorbed by the surface, and how thick or how thin the paint is applied by the one doing the work. The following, however, should enable anyone to make a fairly close estimate under average conditions:

Body of Building. Multiply the distance around the building by the average height to ascertain the number of square feet of surface. Estimate any additions necessary for gables, bays, and the like. Divide the total number of square feet by the covering capacity of the particular material you are going to use, which information can be obtained from the dealer from whom you buy your paint.

Trim Color. For a full trim, including corner boards and cornice, on the average dwelling, about one sixth as much paint as is required for the body color is generally figured.

Blinds, Porch Ceilings, Porch Floors and Steps. The number of square feet of these and other miscellaneous surfaces can be easily measured.

Do not hesitate to consult your paint dealer about your painting and decorating problems.

Thorough Mixing Is Important

To obtain good results from any paint, it must be thoroughly mixed. Otherwise, the heavy pigment will go to the bottom and the top part of the paint will be too thin to give good results. A container of paint should be stirred to a uniform consistency *immediately before* and at intervals during application.

Stirring round and round does little good. A flat paddle should be used, starting with the end of the

paddle at the very bottom and bringing it up through the paint with a turning, twisting motion.

Choosing Brushes

Good brushes and the right kind of brushes are important. They help to make painting easier as well as to give a feeling of satisfaction with your work by eliminating annoyance through loose bristles, unsightly brush marks, and general unhandiness certain to be experienced in wielding inferior brushes.

Cheap brushes should never be used; they are dear at any price. Get a good brush and keep it in good condition for future work.

Exterior paint brushes are of two general types—round and flat. Some painters favor one, some the other. The round brush will carry more paint and permit brushing thoroughly into the surface, but the flat brush is a little easier to use. Careful workmanship with either type of brush, however, will produce good results.

The size of the brush depends upon the surface being painted and the personal preference of the painter. Select a brush as large as you can handle properly, judging the size by your wrist strength. A brush too large is tiring, and one too small is a waste of time. Take one that fits the hand without slipping.

Ordinarily from 3 to 4 in. wide flat brushes or from 2½ to 3 in. round brushes are used for general house painting. In addition, a couple of small brushes are useful for the smaller surfaces. A 2- or 2½-in. flat brush is about right for trim color and similar work, and a small "sash tool" is generally most satisfactory for window sash and the like.

How to Keep Your Brushes in Good Condition

All new brushes, even the very best, contain some short, loose hairs. These should be worked out before the brush is used. Strike the bristles sharply against the palm of the hand several times and hold the brush against the light. You may see several bristles sticking up. Pick these out and repeat until no more loose hairs appear. Just before starting to paint, work out any remaining hairs by dipping the brush into the paint and brushing over an old but clean piece of board a few times.

When through painting, clean your brushes immediately. This is not difficult if you go about it the right way. Pour some gasoline, naphtha, or turpentine (gasoline, of course, being much the cheaper) into a small deep receptacle, such as an empty coffee can or a well-cleaned tomato can. Dip the brush into the receptacle and press down on it so that the bristles are spread out; then turn the brush in the hand, releasing the pressure and

pressing down again as you do so. This separates the bristles and gives the gasoline an opportunity to wash out all of the painting material. Two or three cleanings with fresh gasoline will take out practically all of the paint.

Next give the brush a final washing with soap and warm water. Dry the bristles with a cloth and leave the brush in the open air for a time, until thoroughly dry. Finally place the brush in a paper bag or wrap it in a piece of paper to keep it dust free until you are ready to use it again. Do not keep it in a hot, dry place, as this will cause the block to shrink and the bristles to come out.

If necessary to leave a paint brush overnight without cleaning, place it in a container of two parts raw linseed oil and one part turpentine—sufficient to cover the bristles entirely and keep the air from hardening the material in the brush. A tack placed in the handle will permit suspending the brush from the edge of the pail, or a hole in the handle will allow it to hang from a wire placed across the top of container, thus keeping the brush from standing on the ends of the bristles, which would bend and injure them. Never let a brush stand in water or put it away damp, as moisture softens the bristles and makes them lose their springiness and strength.

Painting New Wood

One of the principal things the painter learns from his years of experience is the proper manipulation of painting materials with thinners, according to the condition of the particular surface he is painting. While no information can be given which will supplant the painter's experience, there are certain fundamental principles and general directions which will help greatly in assuring a good job.

Ordinarily there is not a great deal of preparatory work to be done on a new building before the painting is started. The important thing with new wood surfaces is to have the painting material adapted to the absorption requirements of the wood. Generally speaking, woods may be divided into three different groups: Extremely porous or absorbent, including red and white cedar, and California redwood; medium absorbent, including white pine, poplar, basswood, and elm; close-grained, oily, and non-absorbent, including Southern or yellow pine, hemlock, spruce, Northern pine, and fir.

The more porous and absorbent woods require a priming coat that is unusually rich in linseed oil, with a small amount of turpentine added. The less absorbent woods need less oil but more turpentine to help the oil penetrate well into the wood.

Assuming a three-coat job, which

is generally required for the satisfactory painting of new wood surfaces (for reasons which will be explained a little later on), let us take up each coat as follows:

First Coat. The first or priming coat should always carry enough linseed oil to satisfy fully the oil-hungry, bare wood and still leave enough oil in the paint film to bind and hold it together. Some turpentine should always be used in the first coat. The amount of oil and turpentine will vary according to the kind of wood, as indicated above.

Second Coat. The second coat should also contain a liberal amount of oil, although not as much as the priming coat, and a considerably larger amount of turpentine in proportion to the oil. The additional turpentine tends to make this a very hard coat with little gloss, permitting the following coat to adhere closely. There need be little difference in the thinning of the second coat, regardless of the kind of wood. This coat will be heavier bodied and of greater hiding power than the priming coat.

Third Coat. This should be a full oil, glossy finishing coat with very little, if any, turpentine added. The oil in this coat does not soak into the surface but remains in the paint film to give it resistance against the weather and also to provide its attractive luster.

As will be seen, the absorption demands of the wood are only partially met with the priming coat, and part of the oil in the second coat is required to satisfy completely the demand of the wood for oil, while the third coat is required for adequate protection. This is the answer to the question of how many coats should be used for painting a new house.

Repainting Wood Surfaces

After the surface has been properly prepared, you are ready for the application of the paint.

Ordinarily two coats are required for a good repainting job, although one coat will sometimes be sufficient if the surface is in extremely good condition. Some home owners make a practice of repainting one coat every other year, instead of doing a two-coat job at intervals of three

Brushes and a good extension ladder for reaching both high and low surfaces are the principal equipment needed for painting.

and a half to five years, which has been found to be the general average for keeping a house well painted.

Assuming a two-coat job, the procedure outlined below should be followed, although it is, of course, impossible to give exact amounts and specific proportions without knowing the kind of material that will be used and making a personal inspection of the surface.

First Coat. This should carry a liberal amount of turpentine in proportion to the amount of oil in the paint, to help the desired penetration into the previous coating and to produce a body coat with little gloss. (The addition of turpentine reduces the gloss of paint, while linseed oil increases it.) Where the surface is extremely soft and porous, more oil should be used; if extremely hard, more turpentine must be added.

Second Coat. This should be a full oil, glossy, elastic finishing coat, to give the greatest resistance against the weather and to produce an attractive, lustrous finish. Very little, if any, turpentine should be used in this coat.

With a one-coat job, only a little turpentine should be used—not enough to reduce the gloss perceptibly. In the case of an old weather-beaten house, practically as much, and often more, oil and turpentine should be used than for very absorbent types of new woods.

Ready Prepared Paints and White Lead in Oil

Full directions are almost always given on containers of ready mixed house paints for applying first, second, and third coats on both new and old work. These directions should be read carefully and followed explicitly.

Where white lead and oil paint is mixed on the job, the use of the proper amount of linseed oil and turpentine in each coat is important. Although it is, of course, impossible to give mixing formulas that will meet exactly the requirements in all cases, the following formulas, based upon average surfaces and average conditions, will give an approximate basis for mixing, from which slight variations should be made according to the kind of wood and condition of the surface, as previously explained.

These mixing formulas are based on the use of what is generally termed "strictly pure white lead," such as has been on the market for years.

New Exterior Woodwork—*First (Priming) Coat.* 100 lbs. white lead, 4 gals. raw linseed oil, 2 gals. pure turpentine, and 1 pt. pure drier make approximately 9 gals. of paint.

Second (Body) Coat. 100 lbs. white lead, 1½ gals. pure turpentine, 1½ gals. raw linseed oil, and 1 pt. drier make approximately 6 gals. of paint.

Third (Finishing) Coat. (Also for second coat on two-coat jobs.) 100 lbs. white lead, 3½ to 4 gals. raw linseed oil, 1 pt. pure turpentine, and 1 pt. pure drier make approximately 6½ gals. of paint.

Repainting Outside Wood—*First Coat.* 100 lbs. white lead, 2 gals. raw linseed oil, 2 gals. pure turpentine, and 1 pt. pure drier make approximately 6½ gals. of paint.

Second Coat. 100 lbs. white lead, 3½ to 4 gals. raw linseed oil, 1 pt. pure turpentine, and 1 pt. drier make approximately 6½ gals.

Soft Paste White Lead

Recently a new form of lead known as "soft paste" has been placed on the market. It contains more oil when purchased than the regular type of lead-in-oil paste. The following mixing formulas are based on soft paste white lead.

New Exterior Woodwork—*First (Priming) Coat.* 100 lbs. white lead, 2¾ gals. raw linseed oil, 1½ gals. pure turpentine, and 1 pt. pure drier make approximately 7¾ gals.

Second (Body) Coat. 100 lbs. white lead, 1 qt. raw linseed oil, 1½ gals. pure turpentine, and 1 pt. pure drier make approximately 5½ gals. of paint.

Third (Finishing) Coat. 100 lbs. white lead, 2½ gals. raw linseed oil, 1 pt. pure turpentine, and 1 pt. pure drier make approximately 6¼ gals. of paint.

Repainting Outside Work—*First Coat.* 100 lbs. white lead, 3 qts. raw linseed oil, 1¾ gals. pure turpentine, and 1 pt. pure drier make approximately 6 gals. of paint.

Second Coat. 100 lbs. white lead, 2½ gals. raw linseed oil, 1 pt. pure turpentine, and 1 pt. pure drier make approximately 6¼ gals.

It should be remembered in studying these formulas that ample time must be allowed for each coat to dry before applying the next coat. This depends to some extent upon the weather. A safe rule to follow in exterior painting is one week between coats, although in fine, dry weather the paint will dry thoroughly in less time. If there is the least bit of tackiness or stickiness when you press your hand on the surface, let the paint stand a little longer. Putting on the next coat before the previous one is dry is likely to cause cracking of the top coat.

How to Apply Outside Paint Like an Expert

When the paint has been stirred thoroughly to a uniform consistency, you are ready to start applying it. Dip the brush into the paint about two inches. Then lift it out and scrape it off several times against the stirring paddle, which should be held over the pail with the other hand; this will squeeze the paint from the bristles. Dip the brush into the paint and scrape it

again, repeating the operation several times. By so doing you will work the paint well into the bristles. Finally, dip the brush into the paint from one to two inches and start applying it with even strokes, using both sides of the brush.

Avoid getting the brush full up to the handle, as this causes spattering and dripping, wastes paint, and makes an even coat impossible. Brush back and forth several times, spreading the paint out well, without bearing down too heavily, until you have a uniform, smooth coat. Remember that to apply thin, even coats of paint is better than to pile on a thick, heavy coat, which may look better temporarily, but does not dry thoroughly and is likely to crack and prevent the surface from being repainted properly unless the previous coatings are burned off.

Window Sash, Porches, and Doors

Window sash is generally painted white, black, or a very dark green or brown, although in some sections red is largely used; and in these colorful times, bright greens and other colors are proving very popular. Often, too, sash is painted in the trim color of the house. The most customary sash colors may be obtained in small cans in regular house paint lines. Sash painting is usually done with a small "sash tool" brush.

A so-called painter's "helper" sometimes is used to avoid getting paint on the window glass. One can be made from a piece of tin and the handle of a discarded coffee pot.

Porch floors and steps are usually more satisfactory if finished with one of the special paints for this purpose, made to withstand foot wear and repeated scrubbing, as well as outside exposure. However, leftover house paint is often tinted to a suitable porch floor color with oil colors, and gives quite satisfactory wear. Because of the severe wear given these surfaces, they may profitably be painted by the home owner in between the times the house is painted.

Porch ceilings are either varnished or painted with light colors; blue, green, and white being most commonly used. For a varnished finish, a high grade spar varnish,

intended especially for outside work, should be employed.

Outside front doors are generally varnished, although with present-day types of architecture, many painted doors are seen in the same color as the house trim. For a varnished finish, spar varnish should be used. For a painted finish, outside house paint is ordinarily used, but exterior enamel gives a more brilliant and lasting finish.

How to Paint Metal

Gutters, downspouts, and the like should not be painted until particular care has been taken to remove all rust, scale, and dirt with a wire brush, putty knife, and sandpaper, and by scrubbing with kerosene, if necessary. It is important to remove all rust; for rust, even if painted over, will eat its way through the paint.

For the priming coat on new metal surfaces, it is best to use red lead or some other metal protective paint. For the following coats, regular house paint of the desired color may be used.

New galvanized iron and tin is always covered with a greasy film, to which paint will not adhere properly. The surface should be washed thoroughly with vinegar, which will remove this oily substance. For the first coat, red lead or some other metal protective paint, or a specially prepared galvanized iron primer, should be used. The following coats may be of any good outside house paint.

Blinds, Screens, Storm Sash and Doors, and Window Boxes

Window blinds, from time immemorial, have been painted green, but with the present colorful era other colors have come into use, as well as some striking new shades of green.

Screens are generally finished with prepared screen enamel, in either black or dark green. The frames may be painted with the same material as the wire, unless it is desired to have the frames in the same color as the house or trim, in which case they may be painted with the house paint. In repainting, scrub both wire and frames, rinse with clear, clean water, and let dry thoroughly; then apply one coat of the screen enamel, brushing it out well to avoid filling the meshes of the wire.

Storm doors and windows are ordinarily painted in either the body or trim color, depending somewhat upon the design of the house. Storm windows are also often painted the same color as the regular window sash. House paint of the desired color is used.

Window boxes are, as a rule, painted green. Desirable shades of green from house paint lines are most generally used for this purpose. Window boxes, of course,

should be attached temporarily, so they can be taken down by withdrawing a couple of screws when the house is painted; then the surface behind them can be painted.

Hints on Painting and Staining Roofs

There are two ways of finishing shingled roofs—painting and staining. As a protective measure, painting is better. However, from the standpoint of beauty, the textured and artistic effects produced by staining are usually considered preferable. Roofs which have been stained previously may be refinished with either stain or paint, but if a roof has been once painted it can never be stained.

New shingle roofs that are to be stained should have one dip coat before being laid and one brush coat afterwards. Shingles can generally be purchased already dipped.

There are some limitations in restaining, because of the transparent nature of shingle stains, and it is generally best to keep the restaining color as nearly as possible the same as the previous color. The manufacturer's directions for thinning should be followed.

Where shingle roofs are painted, it is the usual practice to thin the first coat on new work liberally with linseed oil; and for the second coat on new work, or for repainting work, to add some turpentine to reduce the gloss.

Painting Stucco, Concrete, and Brick

Stucco, cement, and concrete buildings may be preserved from disintegration and waterproofed to prevent the entrance of moisture, as well as beautified, through painting with special concrete finishes. There are two classes of paints now in general use—oil paints and water paints.

The water paints are a newer development. They come in dry powder form to be mixed with water on the job. There is considerable difference in the make-up of products put out by different manufacturers and the directions for applying the particular material used always should be followed carefully.

The oil type paints are similar in character to outside house paints, but are especially formulated for use on stucco and concrete surfaces. Some concrete paints are full gloss, some are almost dead flat, and some have an egg-shell, semi-gloss sheen. The owner should look into this feature, so he will not be disappointed.

No difficulty should be experienced in the use of oil-type concrete finishes on buildings that have stood a year or more before painting, as the active alkali, always present in new stucco or cement, has by that time disappeared. Before painting, any salts or efflorescence seen on the surface should be scraped off.

A wash of zinc sulphate and water should then be applied (mixed in the proportion of three pounds of sulphate of zinc to a gallon of water). No other special preparation of the surface is ordinarily necessary, but the surface *must be thoroughly dry,* and also free from particles of sand and dirt. The directions for thinning the different coats of the particular make of paint used should be followed.

Brickwork should be allowed to stand at least a year before being painted; otherwise the lime in the mortar is apt to spoil the job. Brick is generally painted with regular outside house paint, and where the surface has not been previously painted, the first coat should carry an exceedingly liberal quantity of linseed oil and some turpentine, on account of the very porous nature of brick. In applying the paint, it is a good plan to do a small space at a time, following the joints, so that when the next space is done the laps will come on a joint.

Lawn furniture, fences, arbors, trellisses, clothes posts, and the various little things about the grounds may be kept attractive looking by devoting an afternoon once every spring to brightening them up. Often these accessories are painted the same color as the house, but where the articles are detached from the house they may be painted in attractive bright colors. Exterior house paint is generally used, although outdoor furniture and similar accessories are often finished with enamel.

Common Painting Troubles and How to Overcome Them

Most people who have done any painting have, at times, experienced difficulties of one kind or another in the use of painting materials. Often, also, there are unsatisfactory conditions prevailing that should be remedied before successful results can be expected.

Streaked and spotted discolorations on buildings that have been painted only a short time are caused by painting over knots and sap streaks without first treating them or without treating them thoroughly enough. The heat from the sun draws the pitch out of the knots and sappy places, and it comes through the paint coats and forms a dark-colored mass.

Knots and sap streaks should always be sealed over with shellac—preferably orange shellac—before the priming coat is applied. While many painters touch up these spots with one coat of shellac, any unusual prevalence of pitch and sap stains makes it advisable to coat them over twice. Some painters favor the use of aluminum paint instead of shellac, considering it more effective as a sealer, and also desirable because it will completely hide any surface no matter how dark its color.

Coating knots and sap streaks with orange shellac to seal in the pitch.

Then there is a way to be even more sure that discoloration will not occur, and it is really worth while. That is to go over with a painter's torch all knots and streaks that are excessively sap loaded. The heat draws the pitch to the surface and it can be scraped off with a putty knife. Then the spots should be sandpapered a little, and given two coats of shellac or aluminum. This work, however, should only be done by an experienced painter; otherwise there is danger of a fire.

When Paint Peels

Sometimes paint peels off clear down to the bare wood, and sometimes only in small scales or flakes that seem to be in the last coat. There are a number of reasons why paint peels. The reason in any particular case can be determined only after a diagnosis of the symptoms. In the first place, peeling is generally caused by moisture. It may be moisture in incompletely seasoned lumber. It may be dampness on the surface from a rain, dew, or frost shortly before painting. It may be moisture finding its way out from plastered walls that had not dried thoroughly before painting. Then it may be caused by painting over a sappy, resinous surface that has not been sealed up by shellac, or by painting over a greasy surface—anything that causes an imperfect attachment of paint to the surface.

If the paint peels off clear to the wood, even in cases where the surface may have been repainted several times without previous trouble, the fault undoubtedly is in the first painting of the building. The original priming coat—the first coat—has not been adhering to the wood, although it has not heretofore broken loose and let go.

If the coats separate and the last coat becomes detached from previous coatings, the fault is clearly in some faulty condition of the last painting. Sometimes the paint comes off in small scales or flakes. This is generally termed scaling, and sometimes results from insufficient linseed oil in the paint, which is, therefore, too brittle.

While there are a number of reasons for the peeling of paint, you

can be almost certain that it will not occur if no moisture is present at the time of painting, either in the wood, on the surface, or inside the house; if the surface is free from grease and dirt; if knots and sap streaks are sealed with shellac;

KNOTS
SAP STREAKS
SEAL KNOTS AND SAPPY STREAKS WITH SHELLAC OR ALUMINUM PAINT
EXCESSIVE SAP CAN BE DRAWN OUT WITH A BLOWTORCH AND SCRAPED OFF
SCRATCH OFF PEELING PAINT WITH A WIRE BRUSH AND SANDPAPER WELL
PEELING OF TOP COAT ONLY
PEELING OF PAINT TO THE BARE WOOD

All knots and sappy spots must be "sealed" and loose paint removed.

and if there is a liberal amount of linseed oil and turpentine in the paint, especially in the priming coat.

As to the remedy: When peeling occurs, all the loose coatings must be thoroughly removed. In many cases they can be scraped off with a wire brush. If too bad, they must be burned off with a painter's torch. Then repaint with moderately thin coats.

Blistering and Spotting

Blisters are places in the paint film which become detached from the surface and puff out instead of peeling or scaling off. As a rule they occur only in newly applied paint. They are generally caused by moisture in the wood seeking its way out. The new paint film, being very elastic, stretches and expands into blisters. This form of trouble is most common in midsummer painting, when the heat of the blazing sun draws the moisture out and vaporizes it rapidly. Blisters often disappear in a short time, but nevertheless the paint still remains detached, and when the paint film becomes brittle it scales away.

When repainting, all blisters should be opened up with the corner of a putty knife and all loose scales scraped off as far back as they can be. Otherwise you may have future trouble. The rough edges should be sandpapered down before applying the new paint.

The appearance of spots—"spotting," the painters call it—is generally caused by unusually soft and porous places in the wood, which draw in a great deal of oil from the paint. There is then not sufficient oil in the paint film to give it a gloss over these places. Where wood

is seen to be of a very soft, spongy and porous nature, an extra amount of linseed oil should be used. As a matter of fact, the use of a generous amount of oil will assure freedom from many troubles.

What to Do When Paint Crawls

What is called "crawling" may be due to different reasons. One of the most common ones is a greasy or oily surface. Before painting a greasy surface wipe it with a cloth saturated with gasoline or benzine. Then scrub the boards with a strong solution of hot water and sal soda, and rinse off thoroughly with clear water. Be sure to let the boards become thoroughly dry before painting.

Many times, however, crawling occurs where the surface is not saturated with grease or oil, and it is hard to trace the cause. It may be due to oily deposits that are not visible to the eye. It may be due to too much gloss in the undercoats. Sometimes it is because the surface is wet or cold at the time of painting. Of course, if you find that the trouble is due to a wet or cold surface, you can simply stop painting, or move to another side of the building, until the condition is corrected.

If the reason is not apparent, try adding turpentine to the paint. If this does not correct the trouble, wipe over the surface with a cloth wet with high-test gasoline, turpentine, or naphtha. This will remove greasy substances, if any, and also cut the gloss to allow the next coat to take hold.

Slow-drying or "tacky" paint, as it is generally termed, may be caused by a number of things. One of the most frequent is the use of adulterated linseed oil, kerosene, fish oil, rosin oil, mineral oils or other nondrying oils in the paint instead of, or in addition to, pure linseed oil. Then again, linseed oil which has stood for a considerable while exposed to the air and become rancid, or which has become thick in the bottom of barrels, may cause slow drying. Painting over surfaces that have been washed with sal soda without first rinsing them off with clear water will also sometimes cause it.

Remedies for Paint That Dries Too Slowly

As to what to do where the paint is still tacky at the time of repainting—in some cases a mixture of three fourths turpentine and one fourth drier will dry up the sticky paint. In other cases a coat of aluminum paint will do it. One of these remedies may be tried on a small section of surface. If it doesn't "do the trick," the other one may be tried. If neither one eliminates the sticky condition of the surface, about the only thing left is to burn off the defective coating and repaint.

CHAPTER VI

WHEN PLUMBING GOES WRONG

TO MOST of us the plumbing systems in our homes are like our teeth—we do not realize that we have them until something goes wrong. Even the handy man who does a little carpenter work and painting about his home and perhaps tinkers with his automobile rarely will attempt plumbing repairs, simply because he thinks that plumbing work is difficult and mysterious, requiring a very special kind of skill and unusual and complicated tools.

This is not so. Nearly any man, with the common tools found in almost every household, and without special mechanical skill, can do his own plumbing repair jobs. Most of these are emergency jobs—such as mending leaks that develop suddenly and endanger valuable furniture, rugs, wall paper, and other household possessions. Every man should know how to give first aid in such cases as these. It is no more sensible to permit a serious leak to ruin your house furnishings while you try to summon a plumber than it is to let blood flow from a cut while you wait for your doctor.

The first thing we should learn is how to turn off the water and gas supply to the house. In many modern homes a shut-off valve will be found beside the water and the gas meters.

If there is no shut-off valve in the house, the supply may be turned off at the curb box. This box usually will be found near the street curb at the front of the house. If the position of this box is not known, often it may be located with the aid of an ordinary compass.

First find the place in the cellar where the pipe enters; then, following the line of this pipe and holding the compass as close to the ground as possible, walk slowly to the curb. As you approach the iron curb box, the needle or disk of the compass will be deflected and it is then a simple matter to uncover the box and shut off the water with a key.

The water supply can be shut off from certain pipes by turning the valves found beneath sinks and washbowls, or in the cellar. If you do not know what pipes in your plumbing system these valves con-

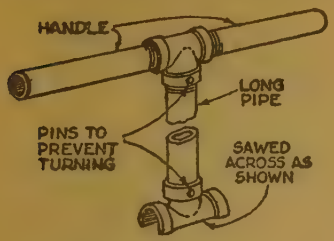


FIG. 1. An easily made "key" for turning a curb valve.

trol, try the valves one after the other, and tag them against possible emergencies in the future.

Figure 1 illustrates an easily made street key for turning off gas or water at the curb box.

Often it will be found impossible to operate the key because sticks and stones have accumulated in the curb box. These may be removed with the aid of a device made as shown in Fig. 2. This consists of a long, thin piece of wood with a ½-in. hole drilled near each end. A looped wire—stiff radio antenna wire will do—is threaded through these holes.

To operate, fish the lower loop over the obstacle to be removed and pull on the upper loop. The obstruction will be firmly clamped and can be withdrawn.

How to Stop Leaks in Water and Gas Pipes

Leaking gas and water pipes worry the householder perhaps more than do any of the other plumbing ills, yet these troubles can be remedied in many cases with surprising ease.

Leaks at pipe joints—joints where the pipe screws into couplings, unions, and other fittings—are due to strains or excessively worn threads. Unscrew the joint and smear a little thick paint, tar, or other heavy oil compound on the external thread, that is, the thread inserted in the joint.

If this should not stop the leak, clean the thread of the pipe with a strong lye solution so that it is absolutely free from oil or grease. (Lye should be handled very cautiously.) Remove the lye solution with clean water and coat the thread with a low melting point

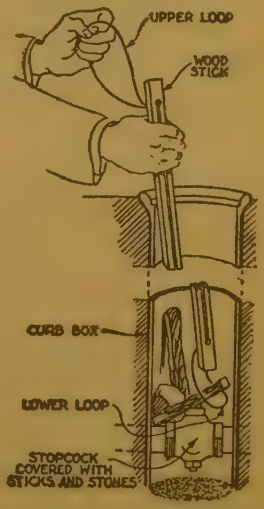


FIG. 2. Snare for removing débris from a curb box.

paste solder and heat with a flame until the solder has melted and formed a coating over the threads, but do not let it fill them up.

Litharge mixed with boiled linseed oil forms a thick pasty pipe thread "dope" that can be depended upon.

If leaks are due to rusting or freezing, shut off the water and close the rupture or hole as much

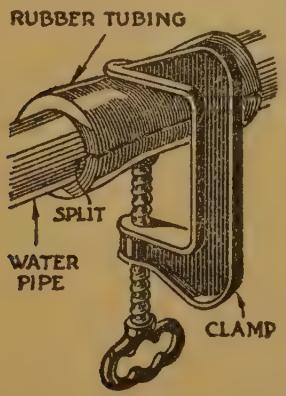


Fig. 3. One way to repair a leaking pipe temporarily.

as possible by peening it with a ball-peen hammer. Coat the hole or fissure with a thin layer of iron cement. Then wrap the affected part of the pipe very firmly with splicing compound tape such as is used by electricians. Over this wrap tightly a layer of friction tape.

If iron cement or tape is not available, the leak may be temporarily repaired by cutting a piece about 2½ in. long from an ordinary hose, slitting it down the center, and slipping it over the pipe. Fasten it in place over the leak with a common C-clamp (see Fig. 3) or other clamping device. If a clamp is not available, an ordinary strap hinge and a large carriage bolt and nut make a very effective clamp.

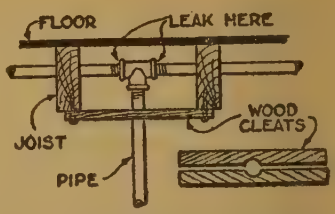


Fig. 4. Cleats to hold a pipe rigidly and prevent leaks at the tee.

The majority of fitting leaks occur at tees. This is especially true in cases where the pipe that runs into the tee is free to move. In the matter of plumbing an ounce of prevention is worth considerably more than a pound of cure. If the pipe is prevented from moving by the method shown in Fig. 4, the problem of leaking tees will be eliminated.

Connecting Lead Pipes

Contrary to popular belief, it is impractical, if not impossible, to repair a leaking lead pipe by soldering. The pipe must be severed and rejoined. Since exceedingly skillful manipulation is required to cut the pipe at the point of leakage and

wipe the joint, the following method will prove the simplest for the average man:

To connect pipes of the same diameter, secure a union of the proper size and screw each part separately on each end of the pipe, running through about ¼ in. beyond the end. With a tapered pin of the proper size and a hammer, swage over the pipe that projects and expand the lead pipe well into the threaded part of the union. Screw the two parts together in the usual way; a very tight joint will result (see Fig. 5).

To connect pipes of different sizes, procure a cap which will fit tightly inside the larger pipe and drill a hole of the size of the smaller pipe in the end. Push the end of the smaller pipe through the cap and through the drilled hole so that it projects about ½ in. Swage over this part and pour enough melted lead into the inside of the cap to have a layer ½ in. thick. The lead pipe should be scraped to let

Fig. 5. How to join lead pipes with ordinary iron fittings.

the lead take hold. The cap is then driven into the larger pipe so that ¾ in. projects, and this is turned over into the cap. The pipe should also be hammered down to fit the cap closely.

In cases where the rupture is large, so much of the lead pipe must be cut out that it will be found impossible to bring the ends together. In this case two unions are needed. A piece of lead or iron pipe of suitable length is inserted between the unions, bridging the gap between the pipe ends and making up the extra length.

Stopping a Leak in a Hot Water Tank

When a hot water storage tank develops a leak, most householders consider it beyond repair. But a small leak can be stopped easily by driving a tapered plug of white pine or walnut into the hole. The plug should have a very gradual taper with the entering end almost as sharp as a needle. It is driven in with a hammer after it has first been soaked in water. The projecting end is cut off within half an inch from the tank surface.

Where the hole in the tank is ¼ in. in diameter or larger, a most effective and workmanlike repair job can be made by using a stove bolt 2 in. or more in length, a nut, a rubber washer, and two iron washers. Split one of the iron washers with a cold chisel in such a way that it resembles a lock washer. Slip the head of the bolt through the hole in the tank. Now place

the split washer over the bolt and slide the washer against the boiler. Holding the bolt end firmly in one hand, screw the washer in through the hole with the other.

Once the washer is inside the tank, the head of the bolt cannot

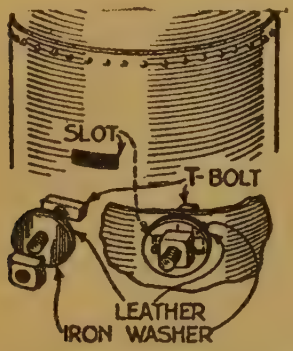


FIG. 6. Method of repairing a leak in a water tank.

be pulled out. All that is necessary then is to put the rubber and iron washers on the protruding bolt and screw the nut tight.

Figure 6 illustrates another very effective method of stopping a water heater tank leak. The hole in the tank is drilled larger, if necessary, and given a rectangular shape with a file. Then the head of a common machine bolt is filed flat, slipped through the slot, and given a quarter turn. A leather or rubber washer is slipped on the bolt, followed by a steel washer and a nut, which is screwed up tight.

A leak in a tank made of extra heavy gage metal may be repaired by driving a tapered steel punch through the hole. This turns the metal inward and forms sufficient surface so that the hole may be threaded by means of a screw tap. Inserting a screw of the proper size will stop the leak.

LEAKING FAUCETS AND VALVES

Faucets and other valves that leak because their washers have become worn waste an almost unbelievably large quantity of water. Two leaking hot-water faucets will cost the householder at least a dollar a year in gas alone—enough to pay for fifty good washers.

Common water faucets found in the home may be one of two types —compression or Fuller. The first type makes use of the screw threads for pressure in closing, while the second depends on the leverage of the handle and the attached rods.

If a faucet leaks when it is closed tightly, the trouble is with the rubber (or fiber) washer located in the main passage. This washer should be replaced immediately, since a continuous dripping of water will add materially to the water bill, and, what is probably more serious, make stained spots on basins, sinks, and tubs through the mineral deposits from the water. These stains become evident in a short time and usually are hard to remove.

The other type of leak commonly encountered is one that allows the water to spurt out around the value stem while the water is turned on and sometimes sprays a part of the wall or furniture or wets the operator. It is seldom, however, that a leak around the valve stem cannot be stopped by tightening the cap or packing nut.

Washers for both types of faucets usually are available at hardware stores. The expense is so small that one can well afford to keep one or two washers in store for each kind of faucet, just as extra fuses are provided for the fuse box of an electric circuit.

Compression Faucets

To repair a compression faucet (see Fig. 7):

Shut off the water at the valve below the faucet, if there is one, or at the valve on the main line leading into the house.

If the shut-off valve is corroded to such an extent that it cannot be turned off (as frequently happens), open all of the water outlet fixtures in the house. This will reduce the pressure to such a low point that there is little danger of the water's spurting over the place when the faucet valve stem is taken out for repairs. A common bottle cork plugged in the valve stem opening will also keep the water from gushing out.

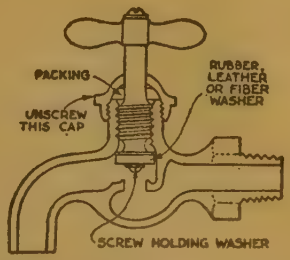


Fig. 7. Ordinary compression faucet, showing the washer and packing.

Open the faucet and let the water drain out. Loosen the cap (packing nut) with a monkey wrench or large automobile wrench. To prevent scarring the finish, put a rag around the nut before applying the wrench.

Unscrew the valve stem by turning the handle to the left until it is removed entirely. Now loosen the screw holding the disk washer.

If the head of the screw has corroded to such an extent that it breaks, cut out the washer first and turn the screw with a pair of pliers. Fasten a new washer in the recess from which the old one has been removed, trimming it to fit, if necessary. A rubber, fiber, or leather washer may be used. A hard washer is preferred for hot water and a soft one for cold. Examine the seat for the washer and make sure that it has not become rough where the washer was worn away. If it has, it should be smoothed. This often can be done with a screw driver or the square

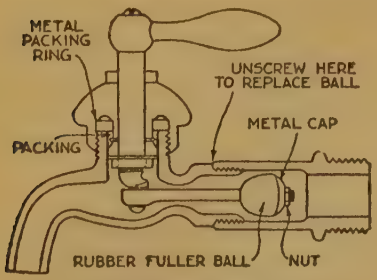


Fig. 8. A Fuller faucet and the ball which can be replaced.

end of a narrow flat file. Some faucets have seats that can be replaced with new ones.

Fuller Faucets

If a Fuller faucet (see Fig. 8) drips or leaks continually, the rubber ball is badly worn. The ball may be replaced by taking the faucet apart between the body and the spud. Replace the old rubber ball with a new one, making sure that the small taper of the ball faces the faucet. Before screwing the body to the spud, turn the faucet handle so that the ball hugs the seat.

A rattling Fuller faucet is an indication that the packing around the stem is worn. Remove the handle and unscrew the packing nut. Then remove the brass or lead ring. Replace the old packing with candle wicking or heavy, soft string soaked in candle grease or heavy oil. This done, replace the metal ring, nut, and handle.

A tool for packing the stems of valves can be made from a piece of brass tubing as shown in Fig. 9. Select a size to fit the valve and large enough inside to slip over the stem. On one end cut an opening with a file and bevel as shown.

The packing is started in the usual way. Then the tool is slipped over the stem and, while being turned with the left hand, is tapped lightly with a hammer.

How to Repair the Mechanism of Flush Tanks

Much expense, both for water and for plumbers, can be avoided if the home owner will learn how the "innards" (see Fig. 10) of a

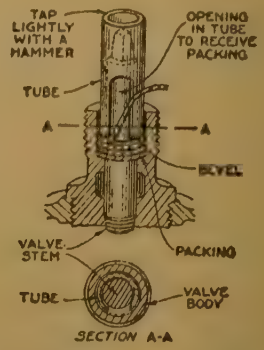


Fig. 9. Homemade tool for packing the stems of valves.

toilet tank operate and go to the trouble of making necessary repairs himself.

The one way to make sure that the toilets in your home are not

leaking is to give them a thorough examination. Put your ear down near the tank of each one and listen. If you hear a murmur, it means there is a leak.

The rod with the round copper float on its end, which you see extending across the tank when you lift off the cover, sometimes

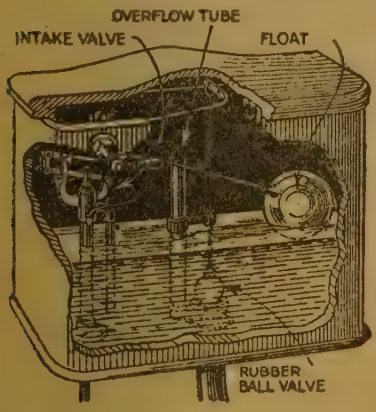


FIG. 10. The internal mechanism of a standard type of flush tank.

gets out of adjustment so that it fails to shut off the inflow valve before the water in the tank reaches the top of the overflow tube. As a result, there is a slow, constant drainage of water.

To remedy this, bend down just a little the rod to which the copper float is attached. This should be done carefully by bending the rod in the middle when holding it in both hands. Do not attempt to bend the rod by grasping the copper float, as you simply will twist it loose. If necessary, you can unscrew the float first; next, unscrew the rod itself, then lay the rod on the floor and hold half of it with your foot while you bend it up.

The effect you seek is, of course, to make the float rest a little lower down in the tank so that it will shut down on the incoming water a little sooner. There should be ½ or 1 in. between the surface of the water when the tank is full and the top of the overflow pipe.

It is not necessary to shut off the water before making this adjustment.

Undoubtedly the greatest single source of trouble in toilets is the rubber ball that is supposed to close the outlet of the tank. It often swells or gets hard, which prevents its making a tight seat with the rim of the flush valve.

You can find out whether the ball is defective by feeling it. Also look into the bowl of the closet and see if there is a dribbling of water. If so, you have learned why your water bills are unreasonably high.

If the ball seems defective or is old and worn-looking, the cheap and effective remedy is a new one. There also is on the market a mushroom ball of heavy, pure rubber, guaranteed for three years.

The tank-ball should be unscrewed from the rod or "stem" to which it is attached. You may find

the thread so corroded that it breaks when you start to unscrew the ball. If so, get a new rod along with a new ball. It will cost only a few cents. A phosphor bronze tank-ball stem, which will not corrode as soon as the commoner kind, is worth getting.

A third frequent cause of leaks is that when the toilet is flushed, the rubber ball does not drop back into correct position, but rests a little off center and does not completely close the outlet. This frequently is due to the guide-arm's being slightly out of alignment with the center of the flush valve. The remedy is to loosen with a knife-blade or other thin strip of steel (there is no room to operate a screw driver) the screw that holds the guide-arm on the overflow tube. After loosening this screw, rotate the guide-arm until the stem and ball are exactly over the center of the flush valve.

A fourth danger spot to examine for leaks is the foot of the 1-in. brass overflow tube previously mentioned. This tube has a fine thread on its lower end, where it is screwed into an outlet leading into the flush pipe. Corrosion often starts a leak in the thin metal where this thread is exposed to the water.

Test the condition of the overflow tube by seeing if it is firm. Sometimes a slight twist will cause it to break off at the bottom because the threaded part is eaten halfway. In case it is defective, a new tube may be obtained at your plumber's. The usual size is 1 by 11 in., but it is safer to measure the old pipe or take it to the plumber to be matched. There is now on the market an overflow tube made of hard rubber, which will not corrode.

If the tube breaks at the bottom, the remaining fragment of threaded pipe must be removed from the socket into which it is screwed. This is not hard to do, as the corroded metal is soft and pliable. Care must be taken, of course, not to damage the thread into which you want to screw the new tube. The guide-arm attached to the overflow must be removed before you can make this replacement.

When the intake valve itself is defective, probably because the washer has become worn, shut off the water supply and remove the two screws which allow the plunger, float rod, and float to be detached as a unit. Look at the seat of the valve, using a mirror if necessary. It must be reseated or reground if it is rough. The washer is held in place with a washer cap, which may be screwed off. Provided the washer is in good condition, it may be reversed and used again. Suitable washers can be purchased—be sure to get the right size—or made from a scrap of oiled harness leather not more than ⅛ in. thick. If the threads of the

retaining screws are stripped, the screws may be replaced with brass cotter pins or with brass wire bent over at the ends so that it will remain in place.

The cheaper types of round copper flush tank floats sometimes spring a leak or develop a hole because of corrosion. This results in a continual flow of water into the overflow tube.

This is easily remedied by heating the float over a gas flame to drive out all moisture. Plug the hole with a copper rivet or an upholsterer's nail. A drop of solder will make it air-tight.

How to Clear Drains That Are Clogged

Clogged plumbing fixtures are in many instances the result of carelessness. Greasy dishwater poured into the kitchen sink adheres to the walls of the trap and waste pipe. The gradually accumulating coating of grease together with other matter, such as coffee grounds, tea leaves, and bits of vegetable peelings, will block the drain in the course of time.

This stoppage, which is usually centralized in the U-shaped trap, may be removed by unscrewing the cap found at the bottom of the trap and working a stiff wire back and forth in both legs of the trap. If the end of the wire is slightly hooked, the withdrawal of the stoppage is simplified.

A plumber's long-handled force cup is a handy device to keep about the house. A good one may be had for less than a dollar.

To use the force cup (generally known as the "plumber's friend") fill the sink about one third full of water and place the rubber force cup over the drain opening. Grasping the wood handle with both hands, push the cup down rather suddenly and just as suddenly allow the cup to regain its original shape. Working the wood handle

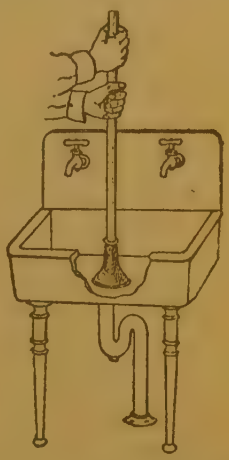


Fig. 11. How a "plumber's friend" or force cup is used.

down deliberately rather than hastily will be productive of the best results. Figure 11 illustrates the use of this dependable device.

Another device known as a "force and lift suction pump," consisting

of a bicycle-type pump attached to a rubber cup, may be purchased. It is more expensive but is more effective than the common force cup.

Still another type of waste pipe cleaner is known as a flexible steel spring auger or coil-spring waste pipe cleaner (see Fig. 12) and consists, in its simplest essentials, of a flexible steel coil. A handle is fastened to one end of the coil, while the other end is shaped like a corkscrew.

These steel spring augers may be had in lengths varying from 3 to

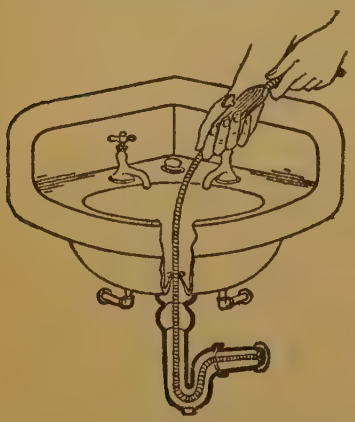


FIG. 12. A coil spring auger for removing obstinate stoppages.

about 25 feet long. Insert the corkscrew end in the clogged trap or waste pipe and rotate the spring as it is forced farther and farther into the clogged system.

Boiling hot water will sometimes clear a grease-stopped trap. If this fails, a solution of caustic potash in hot water or a commercial pipe cleansing chemical sold for the purpose will prove effective in most cases where grease is the offending stoppage.

However, where the stoppage is due to paper, rags, matches, and other organic matter, an alkaline caustic is of little help. To clear a stopped drain of this matter, remove as much as possible of the water from the trap and pour into it slowly about one pint of commercial muriatic acid. Add enough water to make sure that the trap is completely filled with liquid and allow it to stand for an hour or, in very bad cases, overnight. Any stoppage of an organic character is soon rotted to such an extent that it can be flushed away. The flushing must be thorough, as this is a drastic treatment and the acid may damage the pipes. It is more likely to harm new galvanized piping than rusty iron pipes and fittings or lead pipes.

How to Prevent Water Pipes from Freezing

Fortunate indeed is the householder who never needs to worry about frozen water pipes. Modern plumbing installed by a plumber who knows his business will never freeze. However, even in this age of accumulated knowledge, thousands of homes are built with al-

most criminal disregard for the plumbing system's most ruthless enemy—freezing weather. Much of the plumbing, however, can be protected with little effort.

Incasing the piping in all wool or hair felt, in asbestos pipe covering, or in cork is helpful in all except a protracted spell of severely cold weather.

A pressure relief valve such as is used on water heater tank systems, if placed in a line exposed to a freezing atmosphere, will relieve the pressure exerted by the formation of ice in the pipe and prevent the rupture of the piping even if it does not prevent it from freezing solid.

The surest way of preventing pipes from freezing is by shutting off the water at night and at other times when the house is without heat. The pipes should be drained at faucets, drains, and flushes.

A drain cock should be installed at the lowest point in the water supply system. Usually this point is where the pipe enters the house. This drain cock should be fitted with a hose connection in order that the water may be drained through a hose to the bell trap floor drain, if there is one.

All faucets in the house should be opened when the system is being drained in order that air may take the place of the water, which will insure the removal of all the water in the piping.

If the house is left vacant in the winter, about 2 qts. of kerosene should be poured into closet bowls and 1 pt. into each sink, washbowl, and bathtub to prevent the traps from freezing and bursting. Automobile radiator antifreeze compounds, crude glycerin, light automobile oils, strong salt water, or calcium chloride solutions may be used instead of kerosene oil.

Allowing the faucets to leak a small stream of water will often eliminate serious damage to the piping by preventing the building up of destructive pressures caused by the expansion of water into ice.

What to Do When Pipes Freeze

If the methods designed to prevent the freezing of water supply have failed, we have a real problem on our hands. First make sure that the water shut-off valve near the meter will shut off and turn on easily. See that the valve is in the "on" position. Station someone at this valve to turn it off if it becomes necessary to do this during the thawing process. Then open all of the faucets and other outlets.

If you have a small blowtorch, the thawing process is an easy and quick one. Direct the flame of the torch on the frozen piping, being sure to start from the faucet or fixture end. Work towards the meter slowly but without concen-

trating the flame for too long a time on any one small section of the piping.

Contrary to popular belief, thawing does not rupture the piping, although the break or rupture only becomes evident during the thawing process.

When using an open flame take extreme care to prevent fire.

A small electric reflector heater is a safe and excellent substitute for the blowtorch. The radiant heat is easily focused and quickly warms the frozen pipe.

Since one side of the alternating current electric supply is grounded, it is necessary to wear dry rubber overshoes, gloves, or both to guard against a possible electric shock.

Another method of thawing out frozen water lines is to wrap the pipe with old rags and pour boiling hot water on them. Do not pour water on pipes packed with insulating material as it will become soaked and its heat insulating properties will be destroyed.

Frozen drains and rain spouts may be thawed by pouring in a few handfuls of salt or a small can of ordinary lye. Follow this up with a few gallons of boiling hot water.

What is often mistaken for leaking cold water piping is merely what is termed "sweating." "Condensation" would be a more accurate description. The atmosphere, no matter how dry it may seem, always contains moisture; and the warmer the air, the more moisture or water vapor it can carry. However, air at a certain temperature can hold just so much water vapor and no more. When air containing more or less water vapor comes in contact with the cold water pipe, it is instantly cooled; and since it cannot carry as much moisture as before, the excess moisture is deposited on the piping.

"Sweating" of cold water piping is generally a summer complaint and is usually noticeable in cellars where the air circulation is very poor. Sweating may usually be eliminated by leaving cellar windows and doors open. If this is not effective, cover the "sweating" pipe with cork or with air-cell asbestos pipe covering. Hair or felt pipe covering is not recommended for this purpose as there is a tendency for it to become soaked with moisture. Be sure that all joints and cracks in the pipe covering are well sealed; otherwise air will leak in between pipe and covering and deposit its moisture there.

Caring for Garden Hose

Since the garden hose is an important adjunct, a few words about its care and repair will not be foreign to this chapter. Garden hose will last twice as long if it is drained thoroughly after use and rolled into a large rather than a

small coil. The coil should then be hung up in a cool place in the cellar.

There is no excuse for throwing away a hose because it has a few leaks. Many leaks can be easily repaired by using the so-called "cold patches" used on automobile inner tubes. When the patch is made secure, wrap a layer of friction tape over it.

Metal hose menders, which can be purchased for ten cents at any hardware store, will repair a cut or broken hose effectively and quickly. Simply cut out the defective part

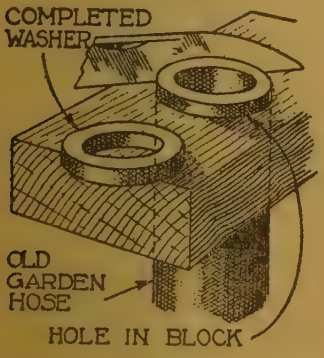


FIG. 13. Guide for cutting hose washers from the hose itself.

of the hose and join the hose together by screwing the ends of the mender into the hose ends.

Satisfactory hose coupling washers may be cut from a piece of old hose or from the hose itself by the method illustrated by Fig. 13. The guide is made by boring a hole through a block of wood. Cut with a wet knife and then scale off some of the outer rubber.

LOOKING AFTER THE GAS RANGE

The gas range is by far the most important gas appliance in the home. However, to receive the greatest satisfaction and benefit from this modern servant, its burners must receive occasional intelligent servicing.

Fumes, blackened cooking utensils, and waste of gas caused by incorrect combustion are the result principally of dirt, dust, and lint, which clogs the various ports and gas passageways. Most gas range difficulties disappear when the burners are cleaned. If the mixture of gas and air is in the proper proportion and the openings and passages through which the gas and air flow are clean, the flames will be clean-cut, greenish-blue, each one distinct and separate from the one next to it.

Generally the first cause of incorrect combustion is dirt and accumulated fuzzy lint. The tools needed to clean the burners are few and simple—a rag, a long wire-handled bottle brush, a small dry scrub brush, and a darning needle or pick of some kind.

If food has been allowed to boil over and burn on the burners, use a kitchen knife to remove the black crust. Then use the scrub brush.

The wire-handled bottle brush is inserted in the front part of the burner where the air is drawn in. Push the brush in as far as possible and twist it around several times before drawing it out. A few gentle taps on the burner will help to release stubborn scales. After the burner has been "dry cleaned" in this fashion, it is sometimes necessary to boil the burners in a strong washing soda solution because of an overflow of syrup or fat.

Dry the burners thoroughly before putting them to use again; otherwise rust scales may form inside the burner and clog it just as badly as though it had never been cleaned.

Open each of the flame holes—or ports, as they are called—by the use of a darning needle, toothpick, or other pointed instrument. Use the cloth for the final dusting.

Adjusting the Flame

Sometimes a kitchen range burner (see Fig. 14) produces yellow flames that reach halfway up around the cooking utensils and blacken the bottoms. This can be remedied easily by releasing the screw holding the air shutter—a flat piece of metal with two or more odd shaped openings in its surface which fits on the front of the burner. The air shutter should be just loose enough to turn with the fingers.

A few experimental turns of the

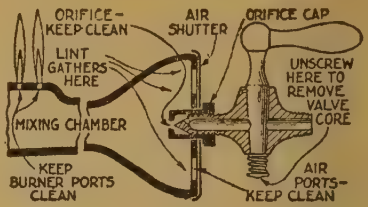


Fig. 14. Section through the valve and part of the burner of an ordinary kitchen gas range.

air shutter will show that when the openings into the burner are blocked, the flame is purplish-blue with yellow tips. When it is turned so that the openings into the burner are entirely free of obstruction, the flame may blow right off and a roaring sound be produced. When the air shutter is closed part way, the desired greenish-blue, lively flame should result.

Should the gas pressure be too high or too low, a common bicycle wrench may be used to turn the part of the valve where the gas flows into the burner proper. The correct name of that part is the orifice cap. If you think of the nozzle on the garden hose, you will have an idea of the way it works. Like the nozzle on the hose, it is turned to the left to give a lower flame; or if more gas is desired, the orifice cap is turned to the right. When the flame is adjusted properly, it should be a bright, clean-cut green-blue flame that comes just to the grates when the valve handle is opened as far as possible.

If the gas range cock turns hard, the core should be removed and wiped of all oil and then lubricated with a graphite base compound or soap. Oil is the worst thing to put on a brass cock. If it still turns hard or if it leaks, it can be reground in 99 percent of the cases.

To regrind it successfully, remove the core—taking care not to lose the screws and washers. Then place a small amount of valve grinding compound or powdered pumice stone and oil on the core and replace in the body, and grind with a motion similar to that used in grinding automobile valves. When the entire surface of the core shows an even dullness, wipe off all the compound from the core and body and lubricate with soap or graphite compound known as bicycle grease.

Improving an Automatic Gas Range Lighter

After an automatic gas range lighter has been in use for a while, it sometimes will cause almost unbearable fumes. Soon it becomes difficult to maintain a flame in the little pilot light. All of these troules are due to the formation of carbon in the combustion chamber of the lighter.

Fig. 15. A gas range lighter improved by cutting a hole in the cap.

The remedy is easy. Simply cut a ¾-in. hole in the top of the lighter cap (see Fig. 15). This hole prevents the flame from coming in contact with the metal parts of the cap. Soot and fumes are entirely eliminated.

If, when the push button is pressed, the pilot light is blown out or a roaring sound is heard, too much gas is being used. This condition can be corrected by means of a hexagon adjusting nut to be found under the button. Use a wrench to screw the nut closer to the button.

There is also a screw on the side of the fitting near the button to adjust the height of the permanent flame, which should be about ⅝ in. long.

Water-Heating Coils

By flushing out the water-heating coil in the fire pot of your house heating furnace or boiler and by keeping a duplicate coil always on hand so that it can be speedily installed in an emergency, you can forestall trouble with this part of your plumbing system. No coil will give satisfactory results during both mild and extremely cold weather.

Keep water-heater coils and burners free from soot to get the most out of the money spent for gas.

This is easily done by using a long-handled stiff wire brush. Cover the tank with four or five layers of air-cell asbestos sheets. These sheets may be held in place by wrapping them at the top, bottom, and middle with copper radio antenna wire.

How to Read Your Meter

Many find difficulty in checking up their gas or water bills because they do not know how to read the meter. Figure 16 shows the recording dials of a gas meter. The small dial is useful in determining how much gas is being

Fig. 16. A gas meter which registers 108,400 cu. ft. Water meters are read similarly.

consumed by any or all of your appliances. One complete revolution of this hand indicates a passage of ten cubic feet.

To detect leaks in house lines, close all valves in the house. Then if you find, after about thirty minutes' observation, that the hand on this dial has moved, there is certain to be a leak somewhere. Apply soap suds with a soft paint brush to find the leak. The formation of bubbles will indicate its presence.

Beginning at the left, write down the figure that each hand has just passed on the four dials (or three, if it is a three-dial meter), add two ciphers, and you have the reading. Where the hands are between two figures, write down the smaller figure. If a hand is directly over a figure, or so close as to make that figure in doubt, see if the hand on the next lower dial has passed the cipher; if it has, mark down the figure in doubt; if it has not, mark down the next lower figure.

A reading on one date subtracted from a reading on a later date will indicate in cubic feet the amount of gas you have used between those dates.

General Suggestions

A leakage of sewer gas may be detected by applying a piece of chemically treated paper at the joints. This test paper is made by soaking a piece of soft towel paper in a solution made of 1 oz. of pure lead acetate and ½ pt. of distilled water. The paper will become blackened in the presence of sewer gas.

Tight unions, ells, tees, and the like may be loosened by heating them with a blowtorch and applying kerosene or lard oil to the threads. The oil will work into the threads and soften the hardened pipe dope.

CHAPTER VII

ELECTRICAL REPAIRS ARE EASY TO MAKE

THIS chapter is prepared in the interest of those who, if they knew how, could undertake the many and various electrical repairs to their house wiring systems and appliances and make minor changes and improvements.

While the information contained in the following pages is not intended to replace the services of the local electrician for the major electrical jobs that arise, it will, if referred to in hours of need, give the man (or woman, in these modern times) of the household such information as will allow him to go ahead and do some of the jobs that perhaps seemed mystifying when he formerly watched an electrician do them.

If some special cases of trouble are not exactly diagnosed in this chapter, remember that there are many different makes of appliances sold, and there are still many old models in use of all kinds; also, wiring methods differ somewhat in different sections.

When a portable electric appliance fails to operate, the trouble frequently is in the cord and can be remedied easily. The two troubles that may occur are (*A*, Fig. 1) an open and a short circuit.

Simple tests will show the kind of trouble and where it is. To make the tests, a fuse plug block (technically known as a two-plug cut-out), which costs little, an extension cord or two lengths of wire, and a small screw driver are needed.

Fasten the fuse block at a suitable place where you can stand on a dry wooden floor without possibility of touching a pipe or other grounded conductor. Remove the socket from any convenient extension cord. Attach the ends of the cord to the fuse block as at *B*, Fig. 1. Then plug in the cord to the nearest outlet. It will be understood, of course, that any insulated wire of 14 gage may be connected with the light wiring at any accessible point and used instead of the extension cord. Connect the two lower contacts of the block with a short wire called a jumper.

Screw a lamp, preferably 15- or 25-watt, in one socket of the test block and the plug of the appliance cord to be tested in the other as

indicated in *C*, Fig. 1. The lamp obviously will be in series with the cord and appliance when the current is turned on. One of two steps will have to be taken, as follows:

1. Should the lamp light when everything is connected, remove the plug from the appliance, if it is connected with a plug; otherwise, disconnect the plug from the appliance (fans, vacuum cleaners, and

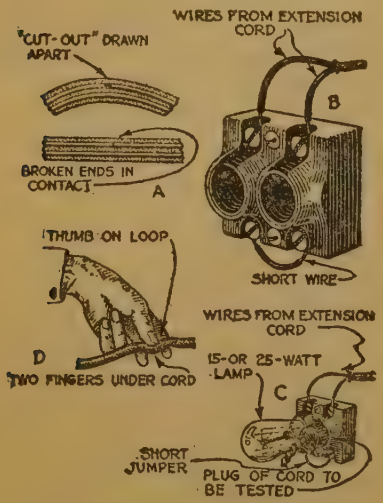


FIG. 1. Testing electric cords for "shorts" and "cut-outs."

the like sometimes use no plug). If this does not put out the light, there is a short circuit in cord or plugs.

Examine the cord at both ends and check especially how the wires are attached to the contact screws. See that the insulation is intact right up to the screw head and that no strands of copper are left loose. If no short is found, hold the cord so as to prevent shaking, which would give false tests, and spread the index and middle fingers to let the cord rest on them. Press the cord with the thumb, bending it down between the fingers, and move slowly along the cord (*D*, Fig. 1). When the location of the short is reached, the lamp almost invariably will flicker.

Most troubles of this kind are located at or within two inches of either the attachment or appliance plug, so that it might be well to remove the plugs, if the short persists, in order to examine the individual wires better.

2. If the lamp does not light when connected with the appliance, there must be an open circuit. Take off the appliance plug and twist the conductors together. Should the lamp then light, test the cord for a cut-out by bending between the fingers as before. In case the light does not flicker, the trouble is in the appliance or contacts and will be taken up later on in considering the care and repair of household appliances.

In the event that the test shows a break in the cord, the best practice is to replace the cord with a new piece rather than to attempt to make a repair, except when the break is near the ends; then the

cord may be cut and a fresh connection made.

Many expensive shorts and frequent opens and cut-outs are caused by poor workmanship in repairing cords. To remove the outer covering, cut very lightly straight around the cord about three inches from the end, being careful to avoid injuring the insulation on individual conductors. Make another light cut from this one, parallel with the cord, to the end. The outer braid now should be removed without difficulty. The cover on some cords will not loosen as readily as on others and must be split on both sides. Take off all rubber and other material that binds the conductors together. This does not, of course, apply to cords having conductors

FIG. 2. How to tie the Underwriters' knot in four operations.

that are not bound together, such as a twisted cord.

The next process in making a cord connection to a plug or a socket is to pass the ends thus separated through the hole provided for the cord, and, referring to Fig. 2, make the Underwriters' knot, which is done in four easy stages. The knot is then pushed back in place to the bottom of the recess provided, and a measure made to the contact screws. From this point the ends of the wires are cleaned of all insulation, the copper scraped

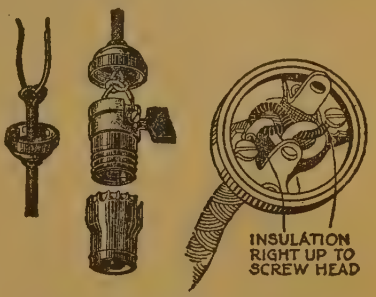


FIG. 3. Connections to an attachment plug and a key socket.

with the back of the knife, and the strands twisted tightly together with the fingers, each into one solid cable. The contact screws are next turned out about halfway, and the twisted wires placed one under each screw, with a turn to the right, after which the screws are tightened, and the surplus copper strands trimmed off close to the screw head with the knife. Blow out all bits of wires and other matter, which completes the job (Fig. 3).

In the event the iron, toaster, percolator, heater, or other appliance cord, which utilizes heat, becomes worn or burned at the plugs, a new one is easily made up. The only correct cord to use is asbestos

covered heater cord, which is procurable in any electrical store.

It is often advisable to replace both fittings on the ends while the new cord is being put on, especially if they show any signs of wear or ill results from the heat. The at-

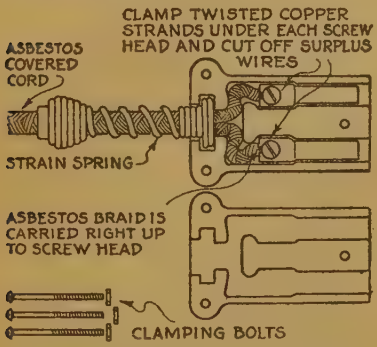

CLAMP TWISTED COPPER STRANDS UNDER EACH SCREW HEAD AND CUT OFF SURPLUS WIRES
ASBESTOS COVERED CORD
STRAIN SPRING
ASBESTOS BRAID IS CARRIED RIGHT UP TO SCREW HEAD
CLAMPING BOLTS

FIG. 4. Inside view of a typical iron plug showing connections.

tachment plug on one end is attached as explained previously and shown at Fig. 3. The iron plug, however, is of different construction. At Fig. 4 is shown a plug in common use, opened for inspection. No knot is tied, as the system of wire channels molded in its inner halves are such that no strain is possible on the screws. The drawing clearly shows how the wires are carefully laid in the grooves, special attention being given to see that the asbestos braid is carried up to the screw heads to prevent a short circuit. The strain spring reinforces the cord at the point where the natural bending would be most acute. This must be carefully laid in its own groove when assembling the plug. When all is in place, the idle half is placed on top, and the bolts provided are used to clamp the assembly together. Take care to apply but moderate pressure with the screws to avoid possible breakage of the composition halves.

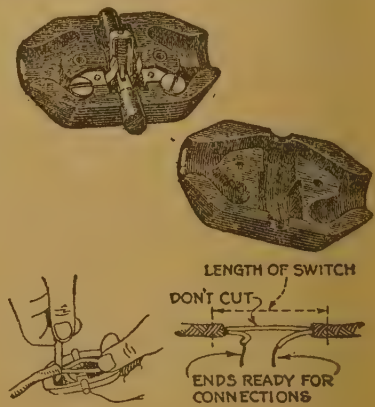


FIG. 5. Four steps in attaching a "through cord" switch.

"THROUGH CORD" SWITCHES

A "through cord" or "feed through" switch has a place in the extension cord of practically every toaster, flatiron, or similar device. To install a through cord switch,

separate the parts by removing the screws (Fig. 5). Determine the desired position and split the cord just far enough to provide for making the connections to the switch but not enough to extend beyond its ends. Cut only the outer braid, which holds the wires together; leave the asbestos covering on the individual wires uninjured. The excess ends of the covering may be cut off with scissors.

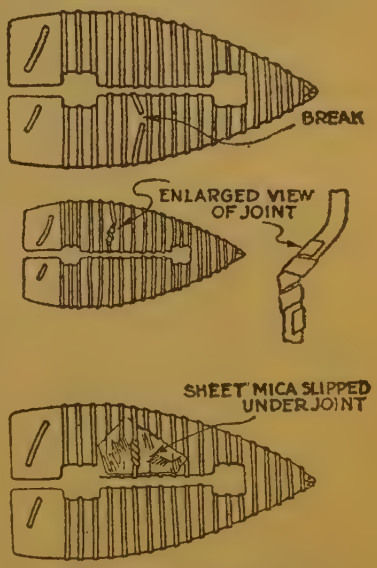
Cut one of the wires in two and remove the insulation from the ends with a knife held at an angle so as not to injure the wire. Leave the other wire with the covering intact. Twist the ends of the bared wires and wrap them carefully around the terminal screws. Trim off excess strands of wire and reassemble the parts. See that they fit perfectly before the screws are tightened.

If one prefers, a connection plug with a toggle switch made integral with the plug is procurable in any electrical supply house, and makes a good method of turning the heat on and off. It is connected to the cord as indicated in Fig. 4.

How to Repair an Electric Iron

When an electric iron[1] fails to heat, the first thing to do is to eliminate the cord and plugs. This is easy if another cord that is known to be good is tried on the iron. If none other is available, test the cord and its fittings as explained under cord repairs.

When you are certain the trouble lies within the iron itself, a test can be made by means of a lamp and test block as shown later on in Fig. 10. Touch one bare wire of the tester on each iron terminal post. The lamp should light. Now touch one wire on the base of the iron and the other wire first on one post then on the other; no light should be obtained.



Figs. 6, 7, and 8. Three stages in repairing the heating element of an iron.

[1] This heating element repair is essentially the same as the repairing of other appliances having elements of the ribbon type, such as toasters.

If these points do not check correctly, dismount the iron and remove the parts that interfere with the exposure of the element. This generally includes the removal of the plug (if it is not already detached), perhaps the handle, and always the top or cover, which comes off when the main screws on top are removed. This will allow access to the element, which may be examined.

Figure 6 is typical of many cases. It is a break in the ribbon element, which would account for no light across the iron terminals. If an element is not available (a new one is recommended), clean the ends of the broken wires with fine sandpaper or emery cloth for about 1½ in. Unwrap one end from around its core one turn to give some extra material and lay the two cleaned ends, one on the other, at a point about 1¼ in. from the ends. Wrap one about the other, making the coils flat and tight. Use what is known as the Western Union splice, Fig. 7. In order to prevent the joint from touching the other wire, it is well to slip a piece of mica under it (Fig. 8).

Test the repair by applying voltage. If the joint gets excessively hot, clean under the folds better and make them tighter. The joint will be improved when the iron is clamped together again. Make sure before again inserting the element that every part of the resistance ribbon is covered by mica, both above and below. Carelessness on this point might result in a "grounded" iron, or in leakage of the current to the base or sides of iron, which must be avoided.

It is sometimes found in the examination of a troublesome iron that the element is in good condition, but the defect lies in burned and pitted terminal posts, caused by the constant removal of the connection plug while the iron is connected to the circuit. These may be carefully cleaned with a small file, to insure good contact. It is also well to mention the insulation block generally placed over the posts to separate them, which should be replaced with a new one if the old is broken or damaged.

Testing and Repairing Fans

Most fan troubles are easily remedied. What you need to know is where and how to look for them.

Rugged and well-built as is the modern fan, it needs to be cleaned and oiled at the beginning of each season and treated with reasonable care. A bad fall or a dry bearing, a weak brush spring or a badly kinked cord may put the best of fans out of commission.

Often the difficulty is not in the motor itself, but in the plug or cord. The first thing to do, then, is to make sure that there is "juice" at the socket by screwing

in a lamp. Then test the cord as explained at the beginning of this chapter.

Once you are sure the "juice" is actually reaching the fan terminals and the fan still will not run, first try turning the fan by hand. See if it turns freely or tends to bind or stick. If it binds, perhaps the oscillating mechanism is jammed, if it is an oscillating fan, or possibly the shaft is dry of oil.

Next examine the brushes and commutator. Perhaps your fan

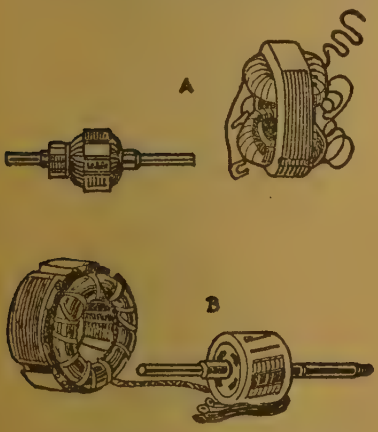


FIG. 9. Brush type motor (*A*) and an induction motor, using no brushes (*B*).

has none; it will not if it is of the alternating-current induction type. If it is of the series-wound commutator type, or if it is a direct-current motor, it will have a commutator and brushes (see *A*, Fig. 9). The brush holders can be removed, usually by loosening a single screw in each.

Perhaps the brush springs are weak, as they may become through overheating. Possibly the brushes are badly worn. The commutator may be oily and dirty, needing to be cleaned with kerosene, and perhaps sandpapered carefully with very fine sandpaper. Clean out the slots with a pointed stick and inspect the fine connecting wires for breaks. If there is a burned spot between two of the bars or segments and it looks suspicious, the armature should be removed and tested, as indicated further on at *A*, Fig. 10. However, a visible spot is not always present, so if other parts of the motor check correctly, the armature should be tested as explained.

If the motor is of the induction type, without a commutator (*B*, Fig. 9), it may have centrifugal fingers that fly out when the motor speeds up. Cleaning them usually will make them work freely, and fine sandpaper can be used to brighten up the points of contact.

If the trouble seems to be merely that the fan binds, lint and dirt may have accumulated around the bearings and need to be removed. If the armature or motor sticks, the bearings sometimes can be realigned by tapping their housings gently with a block of wood. This trouble is not apt to occur unless the fan has been dropped. If the

bearings are badly worn and the spindle has too much play, the small bushings in each bearing can me removed and new bushings inserted.

Now that there is nothing to prevent the fan from turning easily, and the "juice" is being delivered to the motor terminals, it is obvious that there must be something wrong in the wiring itself, if the fan still shows no sign of life. The difficulty is to find just where the short circuit, open circuit, or other defect is located.

Hunting for Defects in the Fan Wiring

First test the starting or speed-regulating device, which may be a speed-regulating coil or a rheostat with switch points; usually it is located in the base of the fan. The easiest way is to use the electric current itself to ferret out the trouble with the test block and lamp in series—the device we used to test cords—but this time with a short piece of cord with an attachment plug on the end screwed into one socket, and the free ends trimmed and bared as shown in Fig. 10.

Test the various terminals by touching two of them at a time with the bare wire points. If the lamp lights, the circuit is all right between the points being tested. If it doesn't light, it is a simple matter to narrow down the hunt to the point where the break has occurred.

It may be found that no light can be obtained across the starting coil, which indicates that this member is burned out. However, make sure there is no visible break near the contact posts. The only remedy for a burned-out coil is to replace it with a new one.

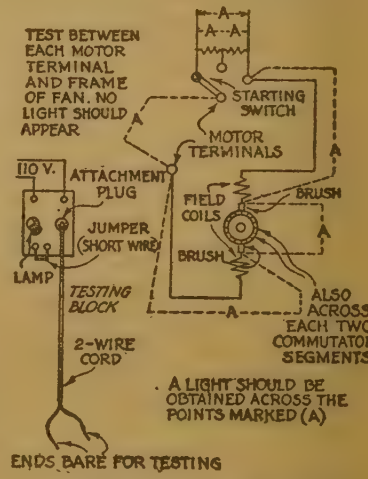


Fig. 10. How to test a series-wound fan circuit or other motor circuit with testing block and lamp.

If the speed-regulating coil or coils are all right, the difficulty is in the motor itself. The wire in the windings rarely breaks, so that the open circuit will be found almost certainly at soldered connections or loose ends.

Examine all connections and ends of wires, carefully removing the tape or binding cord where necessary. The test lamp method used for examining the starting coil

can be used, of course, for further testing the motor windings.

In Fig. 10 is shown the series-connected fan circuit and wires for testing it. All coils are tested and the armature as well. A light should be obtained across all coils marked *A* and by touching adjacent commutator segments all the way around, but no light between any segments and the core or shaft. If these items do not check and if, upon examining the points where each coil is soldered to its segments, they appear intact, a new armature is the best solution.

When the trouble has been corrected, reassemble the fan and fill the oil cups with hard oil, petrolatum, vaseline, or whatever lubricant the fan instruction card calls for. Then open the gear box of the oscillator, if the fan is of the oscillating type, clean it out, and pack with hard oil or grease.

When the Vacuum Cleaner Fails to Work

In the repair of vacuum cleaners the points to bear in mind are that the machine consists roughly of a motor with a fan, a length of cord, and a switch to start and stop the machine. While, as in other appliances, the cord is usually at fault and should be tested first as explained at the beginning of this chapter, the common ills can usually be traced to worn brushes, dirty commutator, dirt and lint tightly bound around the shaft, lack of oil, open coils in armature, grounded armature, and worn bearings.

First remove the cover or housing on the end of the cleaner, exposing the commutator and brushes (see Fig. 11). Herein is found the most common causes of trouble. With fine sandpaper, clean the commutator thoroughly. If grooves and ridges have been cut in the surface where the brushes make contact, the armature will have to be removed and the commutator turned down smooth in a lathe.

See that the brush springs have good tension and that the brushes themselves have not worn off too short, in which case they should be replaced with new ones. Also look at the ends of the brushes and see that they are curved to the contour of the commutator. If fitting is necessary, slip a piece of fine sandpaper under the brush with the sand facing the end of the brush and rotate the armature back and forth until it is ground to a fit.

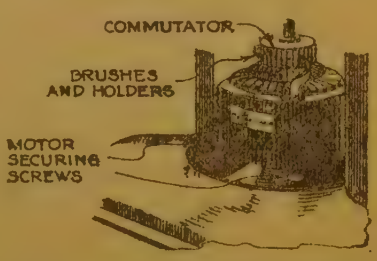


Fig. 11. Cover and bearing support removed from a vacuum cleaner.

In the foregoing work you have been turning the armature. Does it turn freely? If there is any unusual dragging or binding, remove the motor from the frame, usually by removing about four screws (see Fig. 11). Clean the back of the fan from all lint and hairs. Test the fan for true running, bending the blades if necessary to even them up. Clean out all dirt, apply a few drops of light oil to each bearing on both ends, and then assemble.

This will remedy the trouble in many cases, but if failure persists, you will have to look further for the trouble. One common cause, and one it might be well to look at next, is the switch on the handle (Fig. 12) or on top of the motor for controlling the machine. Remove this member by loosening the retaining screws and inspect it to see if the contact arm which makes and breaks the circuit is broken or worn, causing poor contact. If so, replace with a new one. Perhaps the wires are merely loose or broken; they can be easily fixed.

In the event that the cleaner still fails to operate, the only recourse is to dismantle the motor by removing the four screws securing it to the base. Remove the fan by loosening the set screw. To the rear of this will be found some screws, the removal of which will allow the motor to separate.

Make the tests on the armature and field as described for fan motors.

Sparking brushes indicate a dirty commutator, poorly fitted or worn brushes, insufficient spring contact, or an open coil or coils in the armature.

Too much noise is due to worn bearings, the fan's striking, or a sprung shaft; or the belt or brush on power-brush types is out of adjustment.

On types using a power brush, the rubber belt stretches after a time and should be renewed. Turn the cleaner bottom side up to see

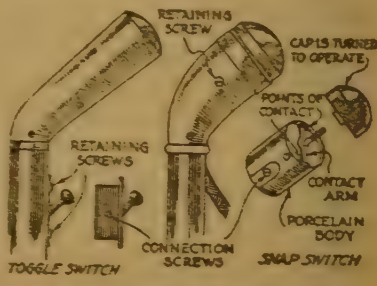


FIG. 12. Two types of handle switches for vacuum cleaners.

how the old brush is removed and a new one put on. Take care to replace the belt so that the brush runs the same way as it did; that is, so that it pulls the dirt under the machine. This is indicated by an arrow on most types. Clean all dust and lint from brush and bearings. If the motor starts and stops or runs irregularly, it may be due to a defective switch, trou-

ble at brushes or commutator, a broken or loose wire, or a broken plug on end of cord.

Failure to start at all is caused by no current at point of attachment, broken switch, open circuit in motor or cord, or dirt, hair, or lint that has become wound around the fan shaft, making armature immovable; or the brushes are not making contact with the commutator.

How to Repair Washing Machines

In the failure of washing machines, outside of the usual cord troubles, which should be looked for first, the most common trouble is the blowing of the fuses.

The switch (Fig. 13) is sometimes at fault. If broken parts are found, or the tension of the spring has been destroyed, put in a new switch. The motors vary from ⅙ to ¼ H. P. on the home machines, and while the running current consumed on the average is not over 5 amperes, allowing for overloads with the wringer and so forth and the extra starting current, it is general practice to use a fuse of 12 or 15 amperes.

Where the trouble points to the motor itself, other tests proving clear, it may be separated from its base by four bolts or screws. The cord is disconnected either at the motor or switch, whichever is the easier, and the motor is removed to the table or bench for inspection.

The first test of the motor[2] is made with the aid of the cord testing block and lamp in series (see Fig. 10). One wire is touched to the frame or body of the motor at a place where it is free from paint, and the other is put first on one of the motor wires and then on the other. No light should be obtained in this test, but a light should burn if testing wires are placed across the two motor terminals. If the lamp lights from either terminal to frame, it gives a clue that the motor may be burned out, but not positively. Remove the four screws on the end

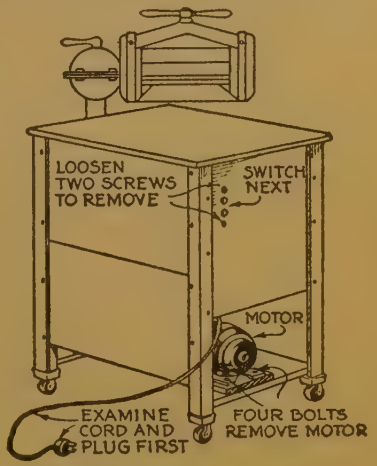


Fig. 13. Location of motor and switch in many types of washers.

[2] The motor and switch repairs may apply to any motor-driven appliance, such as electric ironers and electric refrigerators.

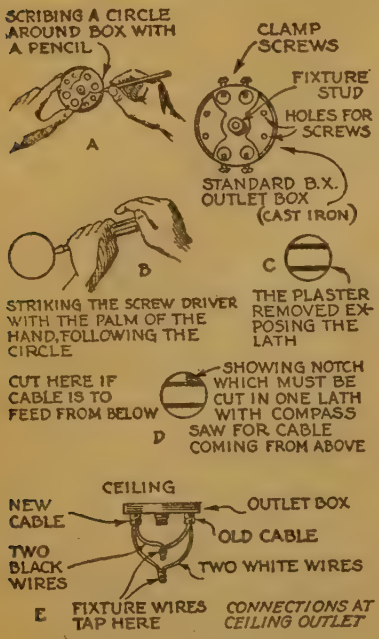

SCRIBING A CIRCLE AROUND BOX WITH A PENCIL
A
CLAMP SCREWS
FIXTURE STUD
HOLES FOR SCREWS
STANDARD B.X. OUTLET BOX (CAST IRON)
B
STRIKING THE SCREW DRIVER WITH THE PALM OF THE HAND, FOLLOWING THE CIRCLE
C
THE PLASTER REMOVED EXPOSING THE LATH
CUT HERE IF CABLE IS TO FEED FROM BELOW
SHOWING NOTCH WHICH MUST BE CUT IN ONE LATH WITH COMPASS
D
SAW FOR CABLE COMING FROM ABOVE
CEILING
NEW CABLE
OUTLET BOX
OLD CABLE
TWO BLACK WIRES
TWO WHITE WIRES
E
FIXTURE WIRES TAP HERE
CONNECTIONS AT CEILING OUTLET

Fig. 14. Four operations in installing a new wall outlet.

of the motor and pry off the end shield with the bearing.

If it has burned out, a burnt smell will be evident, and the insulation on the windings will be brittle and crumble in the fingers, probably with some of the copper wires showing bare in places. If this is the case, don't waste any time; a new motor will have to be purchased.

Should the insulation look intact, examine for bare joints, or wires that touch the frame. In the case of a direct-current motor, clean well the commutator and brushes with fine sandpaper, and check for good contact.

It may be necessary to make the tests as described for fans, if the test lamp indicates an open circuit (no light).

As in the case of fans, a worn bearing should be replaced; it may be diagnosed by lifting the shaft with the hands, trying for lost motion. A loose bearing generally is indicated in a noisy motor.

In the split-phase A.C. motors a form of clutch is often used which should be inspected, as the arc, at the moment of opening, burns the metals so that they may make poor contact. This clutch is usually found on one end of the armature shaft. Clean it thoroughly with a file and sandpaper, as well as the part it touches in the inside of the end shield. In assembling, avoid jamming the wires or causing any accidental damage to the clutch.

Wiring a Wall Outlet

Not often does the handy man attempt extensive repairs or alterations to the permanent wiring of his house, yet he frequently wishes to install an extra wall outlet or a base receptacle. It is not difficult to make additions of this kind, but before a property owner alters the permanent wiring of his house he should inform himself as to local regulations covering wir-

ing, as well as the national regulations. The fire underwriters' code will prove helpful by indicating proper types of construction. The handy man, who intends to do much electrical work, should become familiar with the code so he makes no mistakes. Generally speaking, no objection is likely to be made to wiring changes or additions that a man makes in his own house provided he conforms to the code requirements and takes the same precautions in regard to an inspection that an electrician would be expected to take in order to satisfy the local authorities who supervise building construction and are rightfully concerned in seeing that no improper or defective wiring is used.

The work involved in installing a wall outlet is not great. The material used today for wire is B.X. cable; it is really a great labor saver over older methods.

First determine exactly where the outlet is desired, including the height from the floor. At that point place a "straight electric" outlet box and with a pencil scribe a line around its circumference as at *A*, Fig. 14. Place a screw driver on the line and strike it with the palm of the other hand to make a series of cuts through the plaster, as at *B*. The circle is removed, plaster and all, down to the lath (*C*).

A slot is next made with a compass saw in one of the laths (*D*, Fig. 14), large enough to permit the passing of the B.X. at a point near the top edge of the circle, if the wire is to be carried from above; if the supply is to come from below—the cellar perhaps—the slot is made near the bottom of the circle. In the former case, there is usually a "plate" or "header" along the top of the wall, which must have a hole bored through to allow the cable to pass. If there is a floor directly above, a board must be removed to give access to the header.

Lift up the board and with a brace and a $1\frac{1}{16}$-in. auger bit bore through, making sure you are directly in the center of the header. An extension may be needed on the bit to give room to turn the brace.

Tapping the Nearest Source of Supply

If the wire is to be carried to an outlet in the center of the room (because that happens to be the nearest place of supply), the electricity is shut off and the fixture at this point is removed. The outlet box there is taken down by removing the screws, and one of the spare holes is opened by knocking out the "knockout" washer—a small round disk.

The next operation is pulling in the wire. A piece of steel snake wire—it should be a few feet longer than the run to be made—is car-

ried from the center outlet to the pocket in the floor above the wall. This wire is easily pushed over if it happens that the run is "with" the floor joists, but in the event that the direction crosses the joists, it must be patiently "wiggled" under them if there is sufficient space, as usually is the case. If the snake is turned over after striking each beam, better progress can be made. If it happens that the board which was lifted up above runs in the direction which carries it over the center outlet, this work will be easy without much

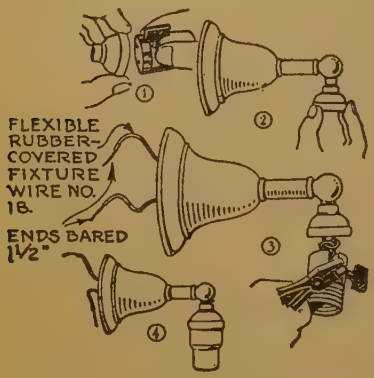


Fig. 15. How to wire a bracket for a wall outlet.

fishing. After the pocket is reached, the B.X. is attached to the snake as follows: Make a small hook on the end of the latter. Trim off about 6 in. of the armor on the end of the cable with a hack saw, separate the wires, and skin about 2 in. of each wire bare with a knife. Wrap the wires around the hook on the end of the snake in the floor pocket. Pull out the snake wire slowly at the ceiling outlet and the cable will be pulled in. Leave the cable amply long enough to reach.

The snake wire is then passed down through the hole in the header which we bored; and, with some assistance below, it is fished out through the slot in the lath at the new outlet. By attaching the free end of the cable at the pocket above and by pulling on the snake wire, it may be hauled down the wall to the hole for the outlet.

Attaching the Outlet Box

The outlet box is attached with screws after the cable is anchored under the clamps provided; then the bracket fixture (Fig. 15) is screwed on to the stud in the center of the box, and the fixture wires are spliced to the B.X. wires by twisting them together and turning the ends over. Then the joints are soldered and taped.

At the center outlet, the old box is replaced after all cables have been clamped tightly. The wires are then cleaned bare on the ends for about 1½ in. and spliced together, color to color (if the wires have colored coverings), and the old fixture is replaced. Tap its wires to the two respective joints,

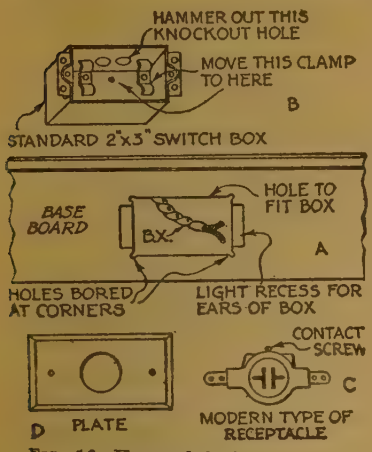


FIG. 16. How a hole is cut in the base ready for the outlet box.

and solder and tape them as they originally were (see *E*, Fig. 14). It remains only to replace the floor and to turn on the electricity.

If the outlet is fed from below, the same instructions apply in a general way. Bore a hole in the bottom header, wall blocking, or floor within the width of the partition, and carry the cable to some outlet in the cellar near by, but be careful you do not tap on the cellar light controlled by a switch.

WIRING A BASE RECEPTACLE

A base receptacle is wired exactly as a wall outlet except that the wire is carried down to the base, where an oblong hole is made to receive the switch box which houses the receptacle (*A*, Fig. 16). This hole is marked by drawing around a standard 2 by 3 in. switch box. With an auger bit, a hole is made in each corner; then a compass saw is employed to cut the hole. It is a good plan to let in the ears of the box by cutting a recess for them with a chisel. The cable is passed through the hole in the box (*B*, Fig. 16). The box is placed in position and held by four flat-head screws; then the cable is clamped tight. The wires are separated, cleaned bare for about ½ in., made into a loop, and connected to the terminal screws on the plug. Then the plug *C* is attached to the box with the screws provided, and lastly, the plate *D* is attached.

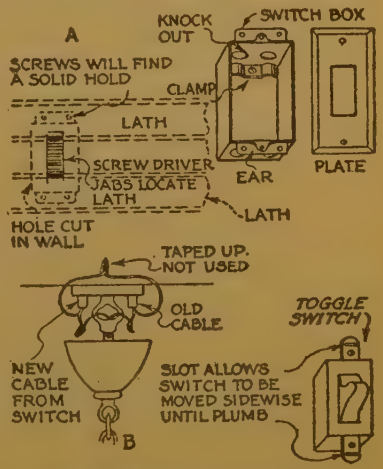


FIG. 17. Method of cutting a wall for a switch box; connecting new wires at ceiling outlet

How to Install a Wall Switch

A wall switch also is installed for an existing outlet by the method described in the explanation of how to wire a wall outlet. The B.X. is carried down the wall and across the ceiling in the same way, but is brought to a switch box (the same type used as above), which is cut in the wall four feet from the floor, near the door. Take care in cutting in the box to "feel" for the laths by inserting a screw driver in successive jabs in an up-and-down line within the length of the box, until a whole lath is found. When placing the box, this lath is located in the center of the opening, which gives half a lath on either end for holding screws (*A*, Fig. 17).

The box switch and the plate are installed exactly as for a base plug. At the ceiling outlet, the new wires are connected as shown at *B*, Fig. 17. Note the unused ends.

Bell Wiring Systems

At *A*, Fig. 18, is shown exactly how to wire a simple bell circuit, consisting of one bell, one button, and two dry cells, such as would be used at the front or back door. At *B* is shown a system for ringing two bells with two buttons, and at *C* is shown one involving four bells, four buttons, and two door openers, such as would be used for a two-family house, with front and back

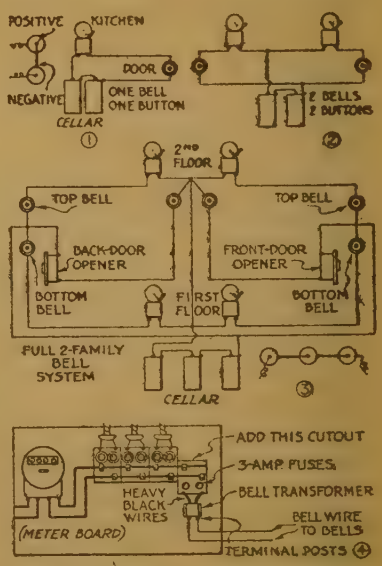


Fig. 18. How to arrange bell circuits and make connections for a bell ringing transformer.

doorbells. The batteries in each case may be replaced with a bell-ringing transformer, *D*. The wire used is annunciator wire, or better still, damp-proof office wire. While it is best to conceal as much of the wire as possible for appearance sake, it is somewhat easier to attach it to the edge of the woodwork with insulated staples.

In bringing wire up to buttons on the outside door casings, a hole is bored from the cellar at a point that will come between the side of the door casing and the first stud. Then bore one through the outside door finish at a con-

venient height for the buttons. With the aid of two snake wires, inserted one in each hole, the bell wires are fished up in a concealed way. They may, however, be tacked along the woodwork, and a hole may be drilled from the edge to the outside location for the buttons, to carry the wires.

To reach the second floor, a shaft is usually employed—the chimney shaft, soil pipe boxing, or laundry chute. As most bells are located in the kitchen, and most kitchens have chimneys near by, the wall on the kitchen side of the chimney is often chosen for locating the bells, and for the door opener button for the back door, as a snake wire usually can be dropped to the cellar easily for pulling up the bell wires.

The door opener is cut in the door casing, taking the place of the striking plates—much the same way as cutting in a mortise lock.

The wires supplying the door opener are fished in the door casing in the same way as the wires for feeding the buttons.

When it is desired to install a tin speaking tube to each door to answer the ring of the bell, the necessary material can be obtained in five-foot lengths, with miscellaneous elbows and tees. It is joined by pushing the small end of one length into the large end of the next piece, which makes the installation of this convenience quite easy. Neatly finished mouthpieces are supplied for the ends of the tube, which merely push in. Large staples are used to fasten the tube to wall and ceiling.

Repairing Electric Bells

When repairs to the bell system become necessary, the most likely causes in their order follow:

Dead batteries. Replace them.

Dirty or corroded contacts in button. Open up button and scrape clean.

Bells out of adjustment. Adjust If transformer is used, a fuse may be blown. Test and replace with new fuses.

Broken wires. Test and put in new wire where needed.

Of all the causes, the most usual is dead batteries. If you have, or can obtain, an ampere meter, you can test them; when new they should read around 25 or higher. If they register but 10, their energy is nearly gone, and they must be renewed.

In cases where one bell only is out of order, it is safe to assume it is not the batteries. Generally it is found that a button has contacts corroded with the weather. Take a piece of sandpaper and brighten them.

To adjust a bell for ringing on a transformer, the gap at the breaker points should be smaller than when used on batteries, because a more

rapid make and break is needed to keep ahead of the alternations of the current. Draw a piece of fine sandpaper between the contacts first, try the bell, and then, if some modification is needed, loosen the set screw and adjust so that when the hammer is pressed against the bell, there is a small gap of about the thickness of a very thin calling card between the screw point and the spring contact. Closing the gap produces a more shrill, rapid ring (most suitable for transformer operation), while opening it gives a slower and more musical sound.

When employing a bell transformer it is best to use the more modern "iron box" type of bell, which is designed for rapid operation, as old-style wooden kinds are sometimes hard to adjust.

Door Openers, Lamps, and Fuses

Door openers, when at fault, often need a little oil in the mechanism. The oil should be applied once a year. The adjustment sometimes has to be altered so that, with no current on, the striker cannot be pressed in. When the button is pressed, an arm is moved by the armature in such a way as to release the striker. Test the striker with these points in mind.

When an electric lamp burns out and another is not at hand, a repair sometimes can be made in this way: Screw the bulb into the socket of an extension cord and turn on the current. Grasp the socket in one hand and slowly turn the bulb, at the same time giving the bulb a series of sharp raps with the other hand. If only one wire of the filament is broken, the two ends will probably touch, and the current will do the rest, welding the ends together and restoring the light. The bulb is, however, apt to be short lived, but may last long enough to save the day in an emergency.

When replacing fuses that have burned out, do not use those of greater carrying capacity than the original ones, as they are the safety valves of your electric system, and it would be like tying down the safety valve on a steam boiler. For the ordinary plug fuses in the average case, use those of 30A rating in the main switch, 20A in the submains, such as meter switches and other taps, and nothing larger than 15A in the branches or the large group of cutouts.

The Story Your Meter Tells

To read an electric meter, start at the dial at the extreme left and take the lowest number, if the hand is part way between two members (not necessarily the one it is nearest, but the *lowest* numeral). Put that one down. Then do the same on the next dial to the right, and so on through the four dials. Do not use a number that the hand has

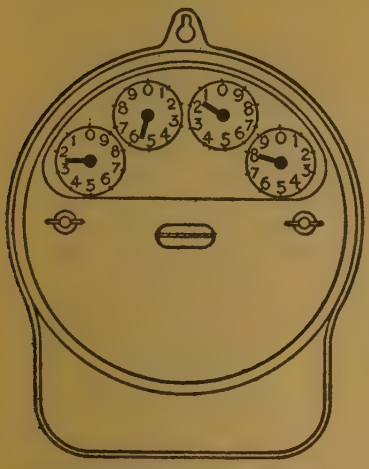


Fig. 19. An electric meter. See if you can read it correctly.

nearly reached but is not exactly on, because its neighbor on the right must make one complete turn before it can move from one figure to the next. For instance, if you found a hand almost on 7 but not squarely on it, the dial on its right would probably be around at 8 or 9 and when it reached 0 the first hand would then be exactly on 7.

Figure 19 shows a typical meter face with four dials. It reads 2,518 K.W., which means that 2,518 kilowatts of electricity have been used to date, or since the meter has been reset. If next month it should read 2,814, it shows that you used 296 K.W. that month and you will be billed for that amount times the rate per K.W. On some meters it states on the front somewhere that the reading must be multiplied by 10 (called the constant) to get the correct reading.

Repairing a Percolator and Other Hints

When a coffee percolator goes dead, it may be that the automatic switch in the base has opened by reason of the pot's having gone dry. Pry off the cover in the bottom and reset, if this is found to be the case.

In the repair of heating elements of the ribbon variety, a good job can sometimes be done with silver solder. Procure a small quantity of silver solder, some borax, and an alcohol blowtorch. Clean well the ends to be mended, lap them, and apply the heat of the torch. Apply some borax, and when the right amount of heat is obtained the silver solder will fuse.

When an electric sunbowl type of heater goes dead, the chances are (if the cord checks correctly) that the element is at fault. This piece is accessible and easy to replace. Simply grasp the unit (located in the center of the parabola) with the hands and unscrew it, as you would an electric bulb. With the test lamp and block (Fig. 10) test the element. Probably a break or open circuit will be found. It is possible to make a temporary repair by twisting up the ends, but a new unit is inexpensive, and may be screwed in easily.

CHAPTER VIII

LOOKING AFTER THE HEATING PLANT

IT HAS been truly said that the heart of the house is in the cellar—the heating plant. No family is happy unless living in an equable temperature, and it takes an efficient and well-cared-for heater to produce that condition. It must be properly installed, suited to the job, of reliable make, and easily serviced when necessary.

Generally speaking, increased efficiency can be obtained by one or more of the following methods:

1. Operating the furnace more economically.
2. Distributing the heat more thoroughly and evenly.
3. Preventing waste of heat.
4. Providing proper humidity.

Hints on Operating the Plant

Shaking the grate too much when starting from a banked fire causes the coals to fall together and clog the air passages between them, stopping the draft. Shake just enough to disturb the coals and start a draft. Throwing in a few shovels of coal every hour or so during the day is false economy.

When shaking, leave the smoke-pipe damper open, and close the check draft and bottom draft door. Never poke hard coal fires from above. Shaking the grate will split the surface sufficiently to allow fuel to fall among the live coals.

For banking, shake out the ashes, fill with coal, then close the damper after allowing a few minutes for gases to ignite. This applies to steam, hot-water, or hot-air furnaces. You will find that less coal will be used and more heat obtained by maintaining a deep fire.

In steam and hot-water systems keep the water at the proper levels. Should water in a steam boiler fall below this correct level, it will lessen the ability to maintain even heat; should it become empty, you may burn out the boiler. Too much water will allow no room for the steam.

With hot-air furnaces, where pipes are used, difficulty in heating may be caused by insufficient air being drawn into the system from outside. The intake opening should be located on the side of the house facing the prevailing winter winds.

Ashes should be removed daily. If they are allowed to accumulate and fill up to the grate, they not only will cut off the draft, but the heat may buckle the grate bars.

A Good Draft Is Essential

Very often the most perplexing furnace troubles lie in a poor draft. Chimney corners filled with soot, clogged smoke pipes, or a chimney of too small a cross section may be the cause. Both strength and quantity of draft are necessary. For that reason it is best to have the necessary chimney area computed by a competent authority.

Most chimneys are high enough to insure good combustion. If, however, you are in a low, flat building and find it difficult to get a strong draft, the chimney may be too low.

For ordinary house-heating plants the usual fuel is hard coal, but other fuels can be burned efficiently after some practice. Coke may prove difficult, but, properly handled, will produce satisfactory results. Large stove coals are hard to use when starting a fire. Buckwheat is small and lies too compactly when burned alone. A special bin of small fuel for starting the fire in the morning is an advantage.

When using coke, or soft coal, be sure not to cover the entire live-coal surface with fresh fuel. Put on the fresh coal in front, leaving the glowing coals on top in the rear.

In steam and hot-water systems the amount of radiating surface may be insufficient in some or all the rooms; or in hot-air heaters the cross section of the registers may not be great enough to supply an adequate quantity of fresh heated air. If you have any reason to suspect that these are inadequate, call on an expert to compute these values for you, for, no matter how well you look after the fire, no matter how much coal you burn, you cannot expect to heat your home if any part of the apparatus is too small for its needs.

Methods of Removing Soot

Soot is the enemy of heat and should be removed from flues, smoke pipe, and chimney periodically. First attack it by means of the fire. Every week or two throw a heaping handful of common salt on the hot coals. This will loosen any small accumulations that may have formed and send them flying. Then, each month, throw an old doorbell battery or radio battery into the fire. The zinc fumes combine chemically with the gases in the furnace to loosen any remaining soot scale. There are also commercial preparations for doing this, but they all have the basic properties of zinc, and old batteries will do the trick very well.

The chimney itself, in the course of years, will accumulate soot that

no chemical action can attack. This must be removed by mechanical means and, unpleasant as the job is, the work *should* be done to eliminate the hazard of chimney fires.

Lower a gunny sack filled with bricks down the chimney and work it up and down until no more soot can be dislodged. A broom for the same purpose can be made by lashing rushes together and weighting them, or by wiring two stiff brushes back to back. Another method is to open up a piece of wire cable so the strands stand out in a spreading brush. Any other similar means will suffice. After the soot has been thoroughly scraped, open up the furnace drafts and drive the loosened residue out into the air.

Reducing the Dust Evil

Slightly wetting the coal helps to lay the dust; but, as every pound of water in the coal must be evaporated before the coal will burn, the efficiency of combustion is reduced that much.

An old vacuum cleaner is useful for cleaning the basement. Much of the dust nuisance can be prevented by sprinkling the floor and even the walls and ceiling with a fine water spray. It is convenient to keep a short piece of hose connected to a tap near the furnace for laying the dust before removing the ashes.

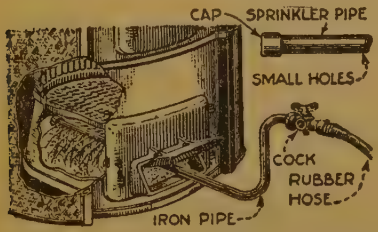


Fig. 1. Simple sprinkling arrangement to wet ashes before removal.

Figure 1 shows a simple homemade spray for wetting the ashes; anyone can make a similar device. A length of ½-in. water pipe is bent in two places as illustrated. The end that is to go into the furnace is closed with a cap, and very small holes are drilled along the underside so as to throw the spray downward. A garden hose cock is screwed on the other end and serves to connect the pipe with a rubber garden hose connected to the water supply.

The spray is used to dampen the ashes before they are removed from the furnace. It should not be operated, however, when the ashes are hot, because steam would be generated and unnecessary dust caused. Shake the fire in the morning and during the day, as necessary, and then, before making up the fire at night, sprinkle the cold ashes and shovel them out. The same spray can be used for moistening coal, as previously suggested.

With a little more work it is possible to insert a sprinkling system permanently in the ash pit directly beneath the grates.

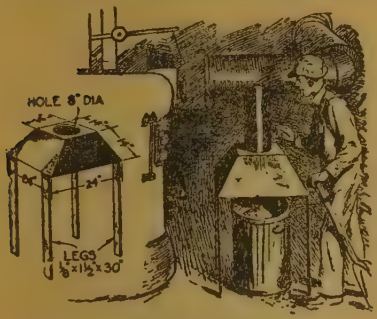


FIG. 2. An ash dust hood that exhausts into the smoke pipe.

The hood illustrated in Fig. 2 is a simple and efficient method of eliminating practically all of the dust when removing unmoistened ashes. Place the ash bucket under the hood and open the damper in the pipe directly above the hood. Close the draft damper to the heating plant. The ashes then can be shoveled into the bucket, and the dust is sucked by the draft out through the smoke pipe.

The hood can be cut out of a piece of light gage galvanized or sheet iron about 40 in. square. The edges may be welded together at a shop or fastened by a small strip and rivets. Strap iron is cut into four legs of equal length and riveted or bolted to the hood.

A damper section of ordinary 8-in. stove pipe of proper length connects the hood with the smoke pipe of the heating plant. When not in use, the ash damper is kept closed.

How to Keep the Air Moist

You will be as warm and comfortable with reasonably moist air at sixty-five degrees as with dry air at seventy-five. Various humidifying devices are sold for use with steam radiators, and specially shaped containers for water can be obtained to hang on the backs of hot-water radiators.

Warm air heating plants are provided with vapor pans, troughs, or tanks for evaporating water, and it is always possible to place an auxiliary pan or tank on top of the radiator drum or in some position where it will humidify the warm air before it passes up into the house.

In hot-air types of furnaces, water should be kept in the pan or trough at all times. The water pans of many furnaces, however, are so

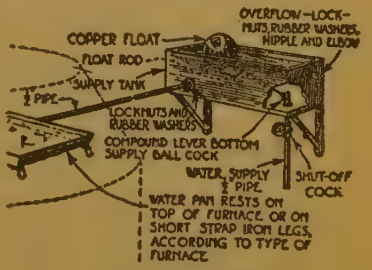

OVERFLOW—LOCK-NUTS, RUBBER WASHERS, NIPPLE AND ELBOW
COPPER FLOAT
FLOAT ROD
SUPPLY TANK
PIPE
LOCKNUTS AND RUBBER WASHERS
COMPOUND LEVER BOTTOM SUPPLY BALL COCK
WATER SUPPLY PIPE
SHUT-OFF COCK
WATER PAN RESTS ON TOP OF FURNACE OR ON SHORT STRAP IRON LEGS, ACCORDING TO TYPE OF FURNACE

FIG. 3. Automatic humidifying pan for hot-air furnace.

placed that not a sufficient surface of water is provided for evaporation. The best plan is to keep an extra pan of water on *top* of the

furnace. It should have as large an area as possible. Place it securely directly on or over the furnace radiator drum. With a pipeless furnace, it can be filled by means of a funnel through the register.

With hot-air furnaces it is a distinct advantage to provide a reservoir tank outside, and both tank and pan can then be controlled by a regular float valve as in Fig. 3. Anyone who has had some experience in pipe fitting will have no difficulty in making such an arrangement, as the tanks can be purchased complete with flexible copper tubing to connect to the water supply pipe at any convenient point. One point of importance is to provide an overflow in the tank so that in case the valve fails to work, the water will not flood down on the furnace.

Overhauling the Heater

The losses from accumulated soot and ash dust are so great that it will well repay you to clean the furnace thoroughly.

As soon as the fire is out in the spring, clean all flues and the upper portions of your steam-heating or hot-water boiler with a wire flue brush (Fig. 4). When the flues and upper works are cleaned, remove all the ashes from the ash pit and clean the pit. Take down your smoke pipe and brush it out thoroughly. Then the smoke bonnet, which now will be accessible, should be freed of all accumulations.

When you replace the smoke pipe, make tight joints where it is attached to the furnace proper and where it enters the chimney. Also be sure it does not protrude into the chimney area, or it will cut off part of the draft. Replace any rotted or doubtful sections with new ones.

Next obtain a plant sprayer or oil gun and spray all the interior surfaces of the boiler with crude oil, light machine oil, or oil taken from the crank case of your automobile. For the exterior portions

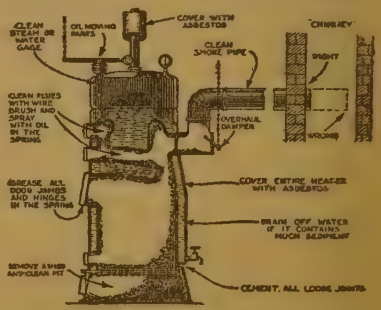

CLEAN STEAM OR WATER GAGE
OIL MOVING PARTS
COVER WITH ASBESTOS
CHIMNEY
CLEAN SMOKE PIPE
RIGHT
WRONG
CLEAN FLUES WITH WIRE BRUSH AND SPRAY WITH OIL IN THE SPRING
OVERHAUL DAMPER
GREASE ALL DOOR JAMBS AND HINGES IN THE SPRING
COVER ENTIRE HEATER WITH ASBESTOS
DRAIN OFF WATER IF IT CONTAINS MUCH SEDIMENT
REMOVE ASHES AND CLEAN PIT
CEMENT ALL DOOR JOINTS

Fig. 4. Diagram showing how to overhaul either a steam-heating plant or a hot-water boiler.

use vaseline or a light grade of automobile grease applied with a rag.

All flue doors, fire doors, clinker doors, and cleanouts are ground on the edges to make contact with the frames. When these ground joints are unprotected during the summer, the moisture of the air forms sulphurous acid by combining with

soot and acts on the cast-iron or steel surfaces with a corrosive action. When ready to be used in the fall the doors may be found coated with scale and the hinges and pins may be so affected that the close and accurate contact of the parts is destroyed. Corroded doors mean poor combustion and loss through fuel waste.

If the boiler is of the metal-jacketed type, the entire outer surface should be greased. Treat the smoke pipe in the same manner as the inside of the boiler and store it in a dry place.

Fill the boiler completely by adding water to that already in it. The water in the boiler has been distilled repeatedly and therefore has less action during summer than new water, but if the water contains an excess of sediment, it should be drained off and the boiler refilled.

Oil or grease all moving or wearing parts of the pressure regulator and cover with an oily cloth to prevent the accumulation of dust. If there is a thermostat, wipe and cover it with a cloth. Any repairs upon it should be done by an expert in handling such devices.

Correcting Boiler Defects

The proper water level for most boilers is indicated when the water in the gage glass is about halfway up. A stained gage glass can be cleaned in the following way: Have several pounds of steam in the boiler. Close both water gages; open the bottom petcock, then the top valve. As soon as steam rushes out through the petcock, close the steam valve and immerse the open petcock in a solution of one cup hot water and one teaspoonful muriatic acid. Let the steam on again until it bubbles through the solution. Then turn off the steam; this will create a vacuum in the glass and cause the acid to be drawn up. Repeat as often as necessary to clean the glass, then close the petcock, open the valves, and the job is done.

Examine the boiler thoroughly and make certain that all cemented joints are in good condition. In sectional type boilers, furnace cement is used to make tight joints between the sections so no burning gases will enter the smoke pipe and go up the chimney without first having completed their travel through the passages of the boiler. Expansion and contraction sometimes loosen this cement; and if the joints are not made tight by recementing, considerable heat will be wasted and the boiler will not perform satisfactorily. Furnace cement is sold at most hardware stores with directions for use.

Make tight joints in other parts of the boiler such as around fire, ash-pit, and clean-out doors; also where the boiler rests upon its base. These points should receive care-

ful inspection and attention if economical operation is expected.

Inspect all vent valves in the basement and on radiators to see that the openings are not covered with corrosion. Test radiator control valves and renew the steam packing, if necessary.

Overhaul the damper regulator and other mechanical devices, making sure they are clean and all moving parts are free from rust and in proper adjustment.

A hot-water system is filled completely to the expansion tank, or special instructions are followed in the case of the so-called "closed system."

Clean all radiators between the sections with a narrow brush made for the purpose, or the narrow tool of the vacuum cleaner. If the dust is not removed, it is later thrown into the room by the heated radiator. This causes the "smell of heat" when the system is first fired up.

Cleaning Hot-Air Furnaces

For hot-air furnaces, remove the outer casing and clean the air-heating surfaces, also the space at the bottom between castings and casing (Fig. 5). Inspect the cemented joints by which the various sections are made tight. If the products of combustion are allowed to escape into the air chamber, a mixture of the two is delivered into the rooms with consequent annoying, if not

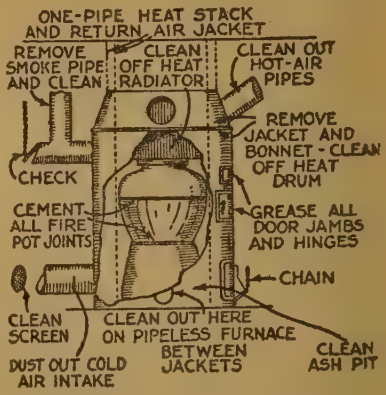

ONE-PIPE HEAT STACK AND RETURN AIR JACKET
REMOVE SMOKE PIPE AND CLEAN
CLEAN OFF HEAT RADIATOR
CLEAN OUT HOT-AIR PIPES
REMOVE JACKET AND BONNET - CLEAN OFF HEAT DRUM
CHECK
CEMENT ALL FIRE-POT JOINTS
GREASE ALL DOOR JAMBS AND HINGES
CHAIN
CLEAN SCREEN
CLEAN OUT HERE ON PIPELESS FURNACE
BETWEEN JACKETS
CLEAN ASH PIT
DUST OUT COLD AIR INTAKE

Fig. 5. How to give a hot-air furnace a general spring cleaning.

serious, results. Inspection and recementing of any joints found defective will insure the delivery of clean, warm air. This applies to pipeless as well as to pipe furnaces.

After the furnace is inspected, floor registers should be removed and the register boxes thoroughly cleaned, as any dirt left there is likely to be discharged into the rooms when the furnace is started.

The fresh-air inlet, commonly called the "cold-air box," should also be thoroughly cleaned of accumulated dust, and the inlet screen should be inspected.

Every year or two the hot-air pipes should be taken down and cleaned with utmost thoroughness.

Applying Asbestos Insulation

If the asbestos covering on a heater has become cracked and dis-

colored, it may be repaired easily with asbestos cement, which can be obtained at hardware and plumbing supply stores. It requires only the addition of enough water to bring it to a sloppy consistency, and is applied with a putty knife or trowel.

After the cracks and holes have been filled up, the former white appearance of the boiler may be restored with a coat of prepared white water paint or kalsomine.

All steam or hot-water pipes should be thoroughly insulated. Even the most expensive covering applied by the highest priced labor is an economy because of the coal it saves.

The easiest method to cover the pipes is with insulating pipe coverings of various materials, which are sold in prepared sections, 3 ft. long. One type of insulation favored by steam fitters for residential work is known as asbestos air-cell pipe coverings. The outer casing of all varieties of insulating sections is muslin or light canvas, which gives them a neat appearance. The sections are clamped in place with japanned tin or brass straps. They are very easy to apply.

Molded sections can be obtained for covering the pipe fittings and ells, but ordinary asbestos cement also can be used for covering all such places as cannot conveniently be covered with the straight sections.

To use the cement for covering pipe fittings or short lengths of pipe, a sheet of clean tin (Fig. 6) is wrapped about the pipe in the form of a cone with the larger opening upward (or, if the pipe lies horizontally, forward). The cement is forced into this with one hand

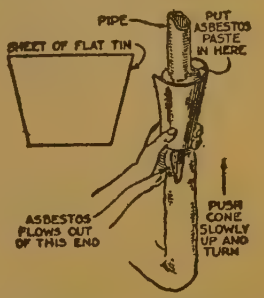


FIG. 6. Applying asbestos cement on fittings and adjacent pipes.

and the tin moved along slowly with the other. The covering comes out of the small end in a compact, smooth mass. While it will not stand rough usage, the cement will remain indefinitely if left alone. By wrapping cloth tightly about the cement immediately after it has been applied, a more durable surface will be obtained.

HEAT REGULATING DEVICES

A large variety of automatic and semiautomatic control devices for heating plants are available. These range from a simple alarm clock draft and damper regulator, which can be purchased for a few dollars

and installed in the course of an hour, to elaborate thermostatic systems which take complete charge of the heating plant and insure a uniform temperature. While the more elaborate types are expensive, they usually pay for themselves quickly by the saving they effect through operating the heating plant more efficiently than can be done by hand. They also save much labor and anxiety on the part of those who have to attend the furnace.

As complete instructions are furnished with all types of regulating devices, nothing need be said about their installation.

In place of the simple alarm clock regulator, the handy man can easily rig up a control apparatus like that shown in Fig. 7. It may be adapted to any make of furnace or heater, whether hot-water, steam,

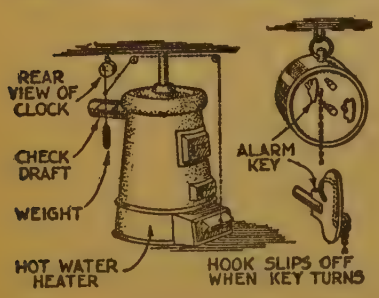


Fig. 7. Simple draft opener operated by an alarm clock.

hot-air, or pipeless, although it is shown as if attached to a hot-water heater. Heating plants differ in design, but with a little ingenuity this device can be made to operate practically any of them. All that is needed is a length of small chain, two pulleys, a weight of from 6 to 8 lbs., such as a sash weight, and an ordinary alarm clock.

The alarm clock, which may be inclosed in a box having a hole that allows the chain to pass through, is arranged directly above the check-draft door. A section of chain is attached to the door and to the key for winding the alarm. The chain should have a small hook attached so that it will be thrown off when the key revolves. When the alarm goes off, the key turns, releasing the chain. The dropping weight closes the check door, opens the draft door, and starts the fire.

Repairing a Broken Grate Temporarily

In an emergency a broken furnace grate often can be repaired temporarily by wiring three iron strips along the depression the whole length of the grate bar. The strips should be not less than ⅛ by 1 in. in cross section and as long as the grate. The wire should be 1/16 in. in diameter or a little larger. Wrap a generous length of it around both grate bar and strips.

The delay often entailed in obtaining new grates from the manufacturer, especially if a furnace is of an old and perhaps a discontinued model, calls for some such emergency repair.

Operating Oil Burning Plants

Because they are labor-savers, clean, and now quite dependable, oil burning devices are rapidly rising in public favor. There are many makes that will pass every test.

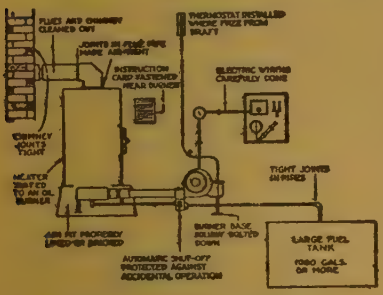

FLUES AND CHIMNEY CLEANED OUT
JOINTS IN STOVE PIPE MADE AIR-TIGHT
INSTRUCTION CARD MASTERED NEAR BURNER
THERMOSTAT INSTALLED WHERE FREE FROM DRAFT
ELECTRIC WIRING CAREFULLY DONE
CHIMNEY JOINTS TIGHT
HEATER ADAPTED TO AN OIL BURNER
TIGHT JOINTS IN PIPES
AIR PIT PROPERLY LINED OR BRICKED
BURNER BASE SOLIDLY BOLTED DOWN
LARGE FUEL TANK
1000 GALS. OR MORE
AUTOMATIC SHUT-OFF PROTECTED AGAINST ACCIDENTAL OPERATION

Fig. 8. Points to be observed in good oil burner installations.

Every owner is advised to study the directions for his particular make and abide by the rules. Let the service man make all adjustments and repairs. Broadly speaking, the following hints will cover any installation.

Be sure your oil company can *always* deliver an adequate supply of the required grade of oil.

No burner can shoulder deficiencies in a poor heating system. Have your heating system examined and put in first-class shape.

Use a large fuel tank with a capacity to take care of oil price fluctuations and to insure you against running out of oil.

Be sure that all flue and chimney joints are thoroughly tight.

Electric service must be dependable, and the wiring expertly done.

Keep the instruction booklet where it will be immediately accessible at any moment.

Automatic control devices must be of the best and fully dependable and efficient.

Do not try to burn too cheap a grade of oil. Use as high a test oil as is specified for your particular make of burner. It always pays in the long run.

Usually the best place for the thermostat is in the living room as far from doors and windows as possible.

The base on which the blower and motor are mounted should be of solid construction, and the frame of the burner should be bolted tightly on the base.

All types of mechanical draft oil burners are fitted with automatic shut-off devices so that the burner will be stopped and the oil supply shut off if anything goes wrong. These devices should be protected to prevent accidental shut-offs if someone unwittingly brushes against the apparatus.

Properly installed (Fig. 8), the fire risk from an up-to-date and approved oil burner need not be considered. Intelligent operation, of course, has its part to play, but the modern burners are so well constructed and expertly tuned to their work that the human equation can be almost entirely discounted.

CHAPTER IX

CONCRETE, MASONRY, AND METAL WORK

MANY repairs about the house and garden can be made economically and easily by the man who knows how to mix concrete and handle a soldering iron. Both cement work and metal work will be discussed in this chapter and a condensed survey will be given of the more common jobs.

Perhaps no material can be handled with less equipment than concrete. When any large amount is necessary, as in laying garage runways or a long sidewalk, it is a part of wisdom either to hire a mixing machine or to buy the concrete ready mixed, which can be done in the larger cities. The ready mixed concrete is delivered in special tanks and must be poured at once.

For the average small job, however, it is no great task to mix the necessary concrete by hand.

The mixing platform should be built of rough green stock. A convenient size is 8 by 14 ft., but a smaller board will serve for most work around the house. A strip nailed to the outer edges on three sides will make it easier to prevent cement being washed over the edges.

For many small repairs you can work up the cement, sand, and water on the sidewalk. Be sure to rinse off the walk before the residue of cement has time to set.

A square-pointed shovel is best for the mixing. A hose or water receptacle, a sprinkling can, a wheelbarrow, a screen for sifting sand, buckets, a steel trowel, and a

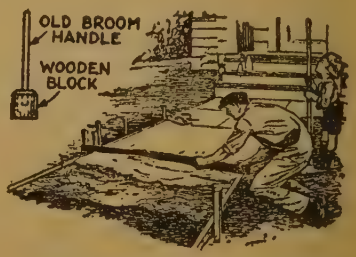


FIG. 1. How a concrete walk is laid, and a homemade tamper.

wooden float are also required. If much sidewalk is to be laid, a groover and edger should be obtained. A tamper can be made as shown in Fig. 1.

The best way to measure the correct proportions of sand and aggregate is to make a bottomless box 1 by 2 by 2 ft. inside and mark

it on the inside with lines 3, 6, and 9 inches from the bottom (Fig. 2). The frame is placed on the mixing board and filled up to the first level if 1 cu. ft. is desired, to the second level for 2 cu. ft., to the third for 3, and to the top for 4. For small work a mixing frame 6 in. by 1 ft. by 2 ft., containing 1 cu. ft., will be large enough. One bag of cement is considered to be 1 cu. ft.

MIXTURES RECOMMENDED FOR VARIOUS CLASSES OF WORK

	Cement	*Sand*	*Aggregate*
Barnyard stable floor	1	2	3
Drives for trucking	1	2	3
Fence posts	1	2	3
Foundation walls and piers	1	2½	5
Garage drives	1	2	4
Garage floors, one course	1	2	3
Garage floors, base course	1	2½	5
Garage floors, surfacing coat	1	2	
Garage foundations	1	3	5
Garden seats, flower boxes, pedestals, etc.	1	2	
Garage walls (6 in. thick)	1	2	4
General reinforced concrete	1	2	4
Large footings	1	3	6
Machinery bases	1	2½	5
Roads	1	1½	3
Septic tanks	1	2	3
Steps	1	2	4
Tanks and cisterns	1	1½	3
Walks, base course	1	2½	5
Walks and floors—surfacing coat	1	2	
Walks and floors laid in one course	1	2	3

Concrete is mixed in different ways for various purposes. Mixtures for common jobs are given in the accompanying tabulation. Most concrete has in addition to cement and sand a certain proportion of bulky material known as the aggregate. This may be crushed rock, gravel, or cinders. In describing a mixture, or "mix," as it is called for short, it is customary merely to mention three figures, as 1:3:5, which simply means that one part of cement, three parts of sand, and five parts of aggregate are to be taken.

Suppose a 1:2:4 batch is needed. First measure 2 cu. ft. of sand and spread 1 bag of cement over it, mixing thoroughly, first dry and then wet; next spread out the mortar and place 4 parts of crushed

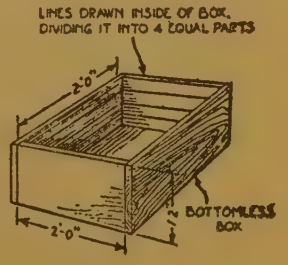


FIG. 2. Bottomless box for measuring the sand and aggregate.

stone on top and mix thoroughly, adding water as required.

If a lighter aggregate is used, such as fine gravel or ashes, it can be mixed dry with the cement and sand before adding water. The object is to have each grain of sand coated with cement, and each particle of aggregate coated with the sand and cement mortar.

Lumber for Forms

For forms, green timber or lumber that is only partly air-dried is actually better than more expensive kiln-dried lumber. The lumber should, however, be of even thick-

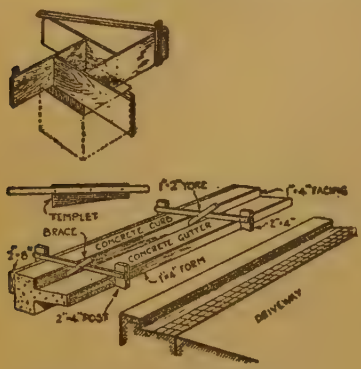


Fig. 3. Standard construction for various types of forms.

ness and preferably planed on one side. The boards should not be wider than 4, 6, or at most 8 in.

Typical methods of constructing forms are illustrated in Figs. 1, 3, and 4. Care should be taken to make them strong enough, since concrete weighs from 130 to 150 lbs. a cu. ft. When forms are to be used repeatedly, they should be oiled or greased beforehand or brushed with oil and graphite. A good oiling mixture is equal parts of boiled linseed oil and kerosene. Even if not oiled, the forms should be thoroughly wetted before use and cleaned afterward.

For foundation walls and similar work the earth usually will serve as one or both sides of the form up to the ground level. Forms should be left in place until the concrete is thoroughly set. Any heavy work is left from ten days to a month.

Rods and bars usually are used for reinforcing concrete, but for light work poultry netting or wire serves very well and is cheap and easy to handle.

It is usually better to spade the concrete into place than to tamp it. An old garden spade or a hoe straightened out are good tools to use.

To join new cement to a section laid the day before, wash the surface well and paint it with cement and water mixed to a creamy consistency. This will make a bond.

Laying Walks and Floors

Concrete for a walk should be laid only on firm, well tamped or trodden ground. Soft places should be dug up and filled with clean gravel or hard cinders. Be sure to have all concrete walls, slabs, driveways, and other flat work extend well below the ground level so that possible subsequent erosion will not expose or undermine the lower edges. The form should be built of 2-in. timbers as wide as the floor or walk is to be thick, and it usually can be held in position with stakes.

The surface of a finished floor should slope about ¼ in. to a foot.

A street walk should slope toward the gutter, but garden walks ordinarily should be crowned about ¼ in. to allow the water to run off on both sides.

One- or two-course construction may be used. In either case, sidewalks should be about 5 in. thick. Masons usually separate a walk into slabs by well-oiled ⅛ in. thick steel plates, which are removed as soon as the concrete has hardened sufficiently. Otherwise care must be taken to cut completely through the concrete when the slab joints are marked out.

A good way for the home worker to lay a walk is first to fill in every other slab and later fill in the inter-

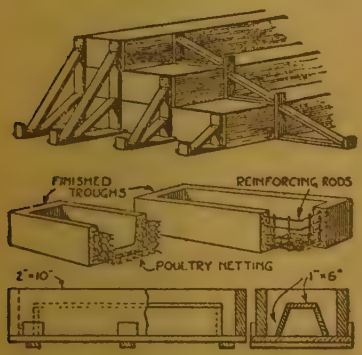


FIG. 4. How to make forms for steps and for water troughs.

vening places. Care in this detail will prevent the walk's cracking. The top edges of each slab should be rounded.

In two-course work the base used may be 4½ in. of 1:2½:5 mixture and a ¾-in. finishing coat of 1:2 cement mortar. A light roller can be used on the concrete as soon as it has been leveled and before the final finish is given with a trowel or float. Although not general practice, walks should be covered and kept moist for several days in order to prevent too rapid drying.

MATERIALS FOR 100 SQUARE FEET OF CONCRETE

1:2:3 MIX

Thickness	Cement	Sand	Stone
2½ in.	5.4	0.40	0.60
3	6.5	0.48	0.72
3½	7.5	0.56	0.84
4	8.6	0.64	0.95
5	10.8	0.80	1.19
6	12.9	0.96	1.43

1:2:4 MIX

Thickness	Cement	Sand	Stone
2½ in.	4.6	0.34	0.68
3	5.6	0.41	0.82
3½	6.5	0.48	0.96
4	7.4	0.55	1.10
5	9.3	0.69	1.37
6	11.1	0.82	1.64

1:2½:5 MIX

Thickness	Cement	Sand	Stone
2½ in.	3.9	0.36	0.72
3	4.6	0.43	0.86
3½	5.4	0.50	1.00
4	6.2	0.57	1.14
5	7.7	0.71	1.43
6	9.2	0.86	1.72

WEARING COURSE—1:1

Thickness	Cement	Sand
½ in.	3.0	0.11
¾	4.5	0.16
1	6.0	0.22

WEARING COURSE—1:2

Thickness	Cement	Sand
½ in.	2.0	0.15
¾	2.9	0.22
1	3.9	0.29

The figures under the headings marked "cement" represent the number of sacks; those under the headings marked "sand" and "stone" represent cubic yards. The stone may be crushed rock, pebbles, or other high-grade aggregate.

Driveways, Posts, and Hints on Patching

Concrete drives to the garage should be about 5 in. thick at the side and 6 in. at the center. As in the case of sidewalks, they should be covered with 2 in. of sand or

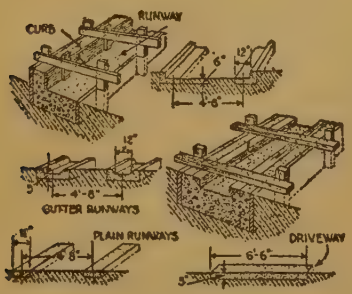


Fig. 5. Three ways of making garage runways and dimensions for a plain driveway.

earth or other moisture-retaining material for at least ten days, and no traffic should be allowed for at least two weeks. If the road is more than 25 or 30 ft. long, provide at least one expansion joint filled with tar paper or asphaltic felt. Concrete strips or runways will often serve instead of solid road to the private garage. Various types of garage drives are shown in Fig. 5. For detailed suggestions for making one popular style, see 184.

Gang molds for posts may be made as shown in Fig. 6. Four or more reinforcing rods should be placed in each post so as to come about 1 in. inside the corners.

Concrete surfaces may be patched up where necessary and left as they appear when the mold is removed, or they may be painted with one part cement and one part fine sand. They may also be washed so as to remove the surface film of cement; this reveals the natural color of the aggregate, which is particularly desirable when selected aggregate, such as granite screenings, feldspar, or hard black slag, are used. If the forms cannot be removed soon enough for the washing process, the surface may be scrubbed, even if it is quite hard, with 1 part common muriatic acid to 3 or 4 parts of water. Other finishes may be obtained by tooling or bush hammering the surface.

Many interesting color effects can be obtained with colors such as red oxide of iron, mineral Turkey red, metallic brown oxide, yellow ochre, ultramarine blue, chromium oxide, and lamp or carbon black.

To repair a break in a sidewalk, carefully remove any broken frag-

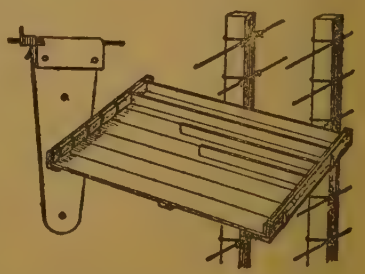


Fig. 6. Mold for fence posts and methods of attaching the fence wire.

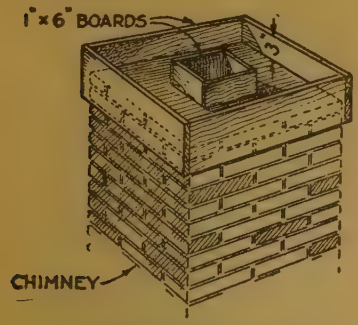


Fig. 7. How forms are placed for a concrete chimney cap.

ments of concrete and with warm water and a stiff brush scrub the broken surface until every vestige of loose material has been removed. Let the water soak well into the old concrete, so that it will not dry out too soon. If the surface is not rough and jagged, roughen it with a cold chisel and a hammer.

Build up the broken place with 1:2:3 concrete for large patches or merely 1 part of cement and 2 of sand for small breaks. See that the top and sides are in line with the old walk. This done, sprinkle a little pure cement upon the wet surface and trowel down.

If the work is done in very hot weather, sprinkle some sand over the repair and cover it with wet rags, which should be kept moistened for several days until the new concrete has set thoroughly. If these precautions are carried out, the bond should be perfect.

When a whole section of walk has cracked, remove the square, lay boards along the sides, then fill to the top of the old walk with base concrete (1:2½:5). Use ½ in. of rich mixture on top and trowel down to match the old work.

Capping a Brick Chimney

When a brick chimney needs to be repaired, it frequently is desirable to provide a cement cap, either cast directly in place or made upon the ground to suit the dimensions of the chimney. Fig. 7 shows how to build the forms for a chimney cap of concrete. To repair a chimney in this way, remove all loose bricks, clean the surfaces, and cement them back with a mixture of equal parts of cement and lime and two parts of screened sand. Then cut four boards of such a size that, when nailed together, they will hold in place at the chimney top. Each board should extend 3 in. above the top. Another form should be built and set in place inside the flue. It is then merely a matter of filling between the boards with cement, mixed in the proportion of one part cement and two parts sand or gravel. It will be well to insert heavy wire or rods at the corners for reinforcement.

Keeping Cellars Dry

Wherever there is a crack, spray water on the concrete for several minutes, letting it soak in well. Then chink the hole with a rich

mortar, preferably with a small amount of lime mixed in, and finish off with a small trowel.

Damp cellars are always a source of annoyance, but they are not always easy to remedy, especially in clay soils.

Sometimes the difficulty is due to the fact that a cement walk runs along the foundation at a distance of perhaps 6 or 8 in. from the wall, so that rain water seeps through the earth between the walk and the wall and enters the cellar. It is ad-

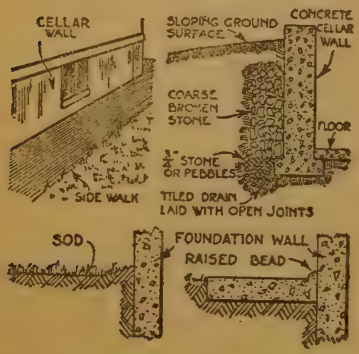


Fig. 8. Methods of preventing moisture from seeping through basement or cellar walls.

visable always to build a walk right up against the wall and slope it well to drain water away (see Fig. 8). If for any reason this cannot be done, the ground between the walk and the wall should be well tamped, sloped away from the wall, and sodded.

To drain off excessive ground water, a tile drain should be laid with open joints, as shown, along the base of each wall. If the concrete foundation wall is fairly good, the water will not enter it, but will drain through the layer of coarse broken stone and pebbles into the tile and flow away to lower ground or a cesspool.

Laying Garage Runways

Although more or less permanent driveways can be made of finely crushed stone, cinders, gravel, flagstone, planks, and other materials, solid concrete ultimately proves the most satisfactory.

Narrow runways, 16 to 24 in. wide and spaced 56 in. center to center, make a neat driveway. Dig the trenches a few inches wide and 5 or 6 in. deep. Tamp the bed thoroughly with a tamper until you can walk on it without leaving a footprint.

Use cheap, green lumber for the forms. The alignment and grade are obtained by establishing stakes at each end of the runway, with a wire or cord drawn tightly between.

Concrete of 1:2:4 mix is recommended for runways. Lumpy cement, if it has not been exposed to dampness, can be rolled out or the lumps removed by hammering with a round stick. Lumps that cannot be crushed in the hand should be discarded.

One "batch" consisting of a bag of cement with the necessary sand and gravel will make 4½ cu. ft. of

concrete, which is 0.167 of a cubic yard. Six such batches make a full yard (27 cu. ft.).

Spread out in the runway, a single batch will make 6.75 ft. of runway 16 in. wide, 6 ft. of runway 18 in. wide, 5.4 ft. of runway 20 in. wide, 4.9 ft. of runway 22 in. wide, and 4.5 ft. of runway 24 in. wide. A width of 18 or 20 in. ordinarily will be found sufficient, and 16 is considered the minimum.

Use a square-pointed shovel, designed for this work. A long handle is usually preferred because it saves some stooping. A garden spade is handy for working the concrete against the forms. When one person is working unaided, a "batch" based, as previously explained, on one bag of cement, will be found about the right size. Dump 2 cu. ft. of sand on the mixing platform, measuring it and the gravel in a bottomless box holding 1 cu. ft.

Spread out the sand and distribute the bag of cement over it fairly evenly. Mix thoroughly by turning over until the entire pile has been moved four times or more. Now add water evenly, by using a hose or sprinkling can, and again turn the pile at least four times. Spread the "mortar" out, and add 4 cu. ft. of gravel on top, and again turn, in this instance at least three times. Add water until the mushy mass when piled settles or flattens out under its own weight, but still does not run all over the board.

Shovel the mix into the forms, taking care to work it down into the corners as you go and force it against the sides of the form. Heap it about ½ in. above the top edge of the form, and shovel the entire batch into the form before smoothing the surface.

Now take a wood "float," which is simply a piece of wood 4 in. wide and about 14 in. long, with corners rounded and a handle in the middle, and carefully trowel the surface until it is smooth and just even with the top edges of the form. All gravel should be worked beneath the surface.

If a rounded corner is desired, use an "edging" tool, and for spacing into sections, as is usual on sidewalks, a groover is necessary.

Leave the end of this section sloping, and immediately mix and place another batch. When you cease work at the end of the day, place a short board at the end of the work. When starting another section the next day, replace the board with a strip of expansion material (asphalted felt). A still better way is to place the expansion strip first, tacked to the board, and then remove only the board when the next section is poured.

If possible, do not use the runways for three weeks or more. When removing the forms, be very careful not to chip or break the edges. As a rule it is best to leave the forms for several weeks, thus pre-

venting too rapid drying of the edges and likewise protecting them from damage until they are hard.

Stepping-Stones for the Garden

Stepping-stones made of concrete are much less expensive and much easier for the home owner to make than a solid sidewalk. In addition, they have the advantage of a more artistic appearance for garden pathways or walks between house and garage. The fact that so many architects now specify stepping-stone walks in connection with designs for costly residences is an indication of their decorative value and growing popularity.

Frost will not injure this kind of walk, for if the individual stones are lifted in the winter, they will settle back when spring comes.

Slabs of several sizes make a more attractive walk than if only one size is used. In the walk illustrated in Fig. 9, a pleasing pattern has been obtained with only three different sizes of slabs.

Three good sizes to use are: 9 by 9 in., 9 by 11 in., and 11 by 22 in. These three sizes can be arranged in a large variety of combinations, with about 2 in. of sod between them.

One form for each size is sufficient to produce a considerable length of walk in the course of a few days, but if more speed is desired, two or more may be used.

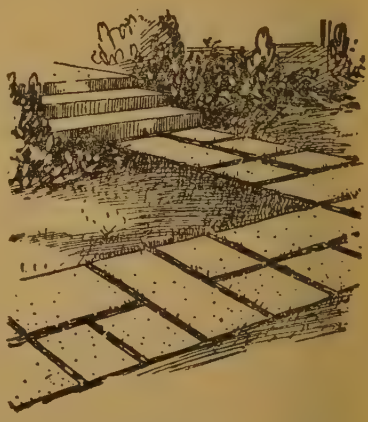


Fig. 9. Stepping-stone walk made of three sizes of concrete slabs.

The form shown in Fig. 10 is made from boards 3½ in. wide. The four sidepieces are connected together with strap hinges as shown. The free ends are provided with a hasp and staple. Upon a smooth floor nail down a false bottom made from ½-in. material; it must be just the size to fit inside the square or rectangle made by the four sidepieces. When the form is placed around the false bottom and the hasp is put over the staple and held by a wooden plug, the form is automatically squared.

A number of the false bottoms set about the floor will enable one to make a number of the stones, one after another. When a stone is finished, the form is lifted away and set up around another false bottom.

If the boards are first given two coats of thick paint, there will be little danger of their warping.

The mixture to be used for the lower part of the slabs can be one part of cement, two parts of sand, and four of coarse, clean gravel.

Now fill the forms to within ½ or ¼ in. of the top edge with the mixture. "Tamp" it down solid and run a trowel around the edges to force the larger pieces of gravel away from the boards.

The work is now ready for the finishing coat, which is made up of two parts fine sand and one part cement. This mixture may be colored to suit the maker's taste and design by the use of special cement colors or even ordinary dry

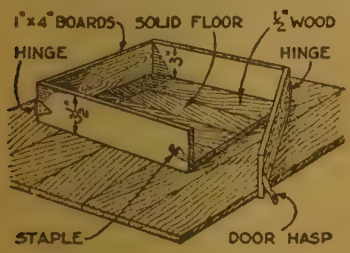


FIG. 10. Mold for making concrete stepping-stones for walks.

Venetian red, burnt umber, yellow ochre, or almost any other inexpensive color, in powdered form. This color should be mixed dry with the cement and sand before water is added. Too much color will weaken the cement.

When the surface has been smoothed with a wooden block, the sharp edges around the form can be rounded with a sidewalk edger, with a small trowel, or, in fact, with a homemade wooden tool.

The slabs are left for one or two days until the mixture "sets." They must be protected from the sun during this process and should be kept moist, particularly if the weather is hot. The forms are used again and again until sufficient stones are made.

When enough slabs have been made for the walk, a sketch should be made showing the best arrangement of their positions. The simplest way to lay them is to excavate as for a continuous walk of the same width and, after the slabs are laid, put pieces of sod between the blocks. One manner of assembling the blocks is shown in Fig. 9.

More irregularly shaped stepping-stones can be made without forms simply by excavating holes in the ground and filling them with concrete.

MENDING BROKEN CONCRETE GARDEN FURNITURE

The fragments should be soaked in water for at least twelve hours. Drill some holes in each piece so that they will face each other exactly in pairs when the parts are put together. If the article is in more than two pieces, it is best to assemble the two largest fragments and, after they are set, add

the others one at a time until the whole has been assembled.

For a drill an old cold chisel will serve. By constantly turning this as you drive it home, you can use it as a star rock drill. The blows should be tempered by cushioning the mallet or hammer with rags.

When the holes have been drilled, immerse the fragments again in water for a few minutes and fill the holes with soft, freshly mixed, pure Portland cement. Place the larger piece so that the break faces upward and secure it so that it is immovable. Insert a few pieces of fence wire in the soft cement.

Wet the edges of the broken pieces again, smear a thin coat of cement over them, and squeeze them together. Remove the surplus cement and cover with wet rags. Do not disturb for twenty-four hours.

Dustless Concrete Floors

Hardeners for making concrete floors dustless can be bought. When it is not convenient to obtain a commercial preparation, the following treatment will render concrete floors dustless for a considerable time and is easily applied:

First scrub the floor with clean water; then allow it to dry thoroughly. Apply a solution consisting of 1 part water glass (sodium silicate) to 3 parts lukewarm water. Use a wide brush or a cloth swab. A second and third coat is advisable, each applied after the preceding one has dried.

Cementing New Concrete to Old

Occasionally it is necessary to make new concrete adhere to old concrete. A perfect bond is highly desirable but often hard to get. Roughening and soaking the surface to be covered is the best general plan. Keep the surface moist for ten hours. Turning a fine spray on it with the garden hose is the best method. Then apply a pure cement paste of the consistency of cream. New concrete can be placed against this with little danger of cracking later.

Setting Bolts in Concrete

Whenever possible, bolts should be set in concrete when the concrete is laid. Should the embedding of bolts be necessary in old concrete, it can be accomplished in the following manner: First drill holes with a star drill large enough to take the bolt heads. Set the bolts in place, then pour melted lead or babbitt around them flush with the top of the hole. Special household cement, obtainable in tin cans ready for use, is also serviceable for setting bolts; or sulphur poured around the bolts will serve as an efficient anchorage.

Waterproofing Concrete

Various excellent proprietary compounds are sold for waterproofing concrete and masonry and should be used when they can be obtained conveniently.

The inside of tanks and basement walls are sometimes waterproofed with water glass (sodium silicate) in the same way that cellar floors are made dustless. This was described on the preceding page.

Setting Posts in Concrete

The mistake of setting wood posts in concrete is often made. Wood expands and contracts considerably according to its moisture content and cracking of the concrete will result. Concrete foundations and posts of either iron pipe or angle iron make a much better arrangement. This type of post and installation will serve for most uses about the home, such as clothes-line posts and garden fence posts.

Figure 11 shows three types of post settings which use either galvanized iron pipe or angle iron. Crown the top of the concrete as shown and extend the concrete below the bottom of the pipe. Usually the hole itself, if made with a post-hole auger or digger, will do for the outer form. A 6-in. collar of sheet metal with the ends crimped so they can be locked together will do for the form above ground.

The central diagram of Fig. 11 shows how pipes can be set in a concrete wall for certain types of

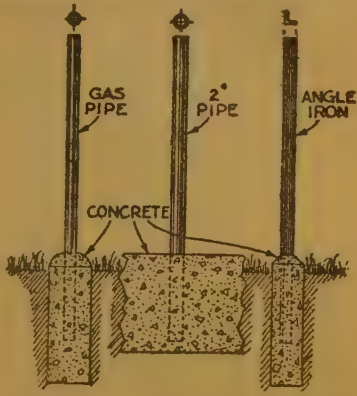


Fig. 11. How pipes or angle irons are set in concrete to serve as posts.

fences. This is especially appropriate for sloping ground where woven wire is to be used above. Reinforcing should be used throughout its length, doubled at the corners. The wall should extend from 2 to 3 ft. below ground and be from 4 to 6 in. wide.

How to Use Cinders

Cinders form an excellent aggregate for some purposes, as when a porous concrete of less weight than usual is desired. Cinders which come from large steam plants are best because they have been through an intense heat, which

leaves only a hard, compact, fused residue.

Cinders should be washed before use. To render this type of aggregate of uniform texture, the cinders should first be broken, then passed through rollers or a screen. No fine ash dust, such as is found in ordinary ashes from a house heating plant, should be used.

Nails can be driven into a cinder block or wall, an advantage which makes this type of concrete construction desirable for hotbed walls and the like.

Cold Weather Concrete Work

Certain precautions must be taken to insure success in cold weather concrete work. Not only must the mortar be kept above freezing during its mixing and placing, but this temperature must be maintained for many hours to make possible the thorough hardening of the concrete.

The aggregate and sand can be heated on a sheet of iron laid on rocks, concrete blocks, or bricks under which a fire has been built. A more satisfactory plan is to heat the water instead, as when this is mixed with the cement and aggregate, the temperature of the entire mix will be raised.

If the temperature of green concrete can be kept above 60° Fahrenheit from the time the mortar is mixed until 48 hours have elapsed, no danger is likely to result. It is good practice, however, to keep concrete above freezing for about a week. Heat hastens the setting action of the cement; cold retards it. However, concrete work can be done in winter on a warm day, and the green work covered with manure, straw, or other insulating material. If the ground in which the work has been placed is frozen, do not rely too much upon insulation from the air; the below-freezing temperature of the earth will possibly do damage.

When frost, snow, and ice are present, they must be removed from forms before the concrete is placed, and the concrete should be poured as soon as it is mixed in order to prevent as little loss of heat as possible.

Frozen concrete is often mistaken for cured concrete. Pouring hot water on it is a good test; if merely frozen, it will become soft.

Repairing Concrete Floors

To repair a concrete floor which has been chipped or marred, soak the spot well with water for ten hours. If the floor is dirty, first clean thoroughly. Then fill the spot with a concrete mortar made of equal parts cement and fine screened sand. Be sure the filling is as high or slightly higher than the old floor. After the mortar has set for forty-eight hours, grind the patch

down flush with the old floor by rubbing it with an abrasive stone.

Hints on Laying Concrete Walks

A cross section through a typical walk is shown in Fig. 12. Boards are set on edge at the sides to serve as forms. The top edges should be as level and straight as possible. If the ground line deviates only slightly from level, then level the edges of the forms; if the ground has a general slope, set the forms parallel with the ground line. These boards may be 4 or 6 in. wide

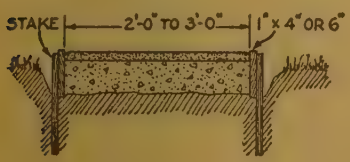


Fig. 12. Section through a concrete walk made in two courses.

and preferably planed on the inside. They are held in place by stakes, and braces may be necessary to keep them in an upright position when the concrete is laid. It is, of course, essential that the bottom of the excavation—the bottom of the walk—be below the ground level. Any necessary fills should be tamped thoroughly and soaked with water.

The first layer of concrete is relatively lean in cement; a 1:2½:5 mixture is generally satisfactory. Before this has had time to set thoroughly, the top layer, ½ in. thick and consisting of 1 part cement to 2 parts screened sand, is laid and troweled or floated smooth.

The walk should be divided into sections of convenient length. Make the cut through all the concrete (a corn knife will do the job nicely) and then finish the top of the walk. The complete division of each section of the walk will prevent cracking from the action of the frost.

Drilling Concrete and Brick

A star drill, so-called because it has cutting edges radiating from the center, is the best tool to use for drilling concrete, brick, or other masonry. In the absence of this drill, an ordinary cold chisel will also do the work if it is slowly turned between the fingers as it is pounded with a hammer. For brick or other soft masonry, a drill used for metal will serve.

Keeping Grass from Cracks in Concrete

When grass or weeds spring up between sections of concrete walks, or other crevices, they can be killed most readily with one of the brands of weed killer on the market. While there are advantages connected with the use of these prepared products, which are convenient and efficient, it is also pos-

sible to kill the grass by sprinkling salt upon it or applying any oil such as kerosene or gasoline. Usually one application in a season will be sufficient.

Concrete for Farm Uses

In one of its bulletins a well-known cement association has explained a simple and satisfactory way for preparing concrete for numerous uses on the farm, where the ordinary moist mixture of sand and gravel is used as the aggregate. The methods of measuring previously described will not serve with this type of aggregate, but by following these suggestions, which are reprinted in part from the bulletin mentioned, the farmer can be sure of his results.

For convenience, the mixtures may be divided into four classes based upon the amount of water used per sack of cement in mixing.

Class A. Concrete mixed using 4½ gals. of water for each sack of cement when ordinary moist sand-gravel is used. (One sack of cement will make approximately 3 cu. ft. of concrete.) For posts—fence, clothesline, and sign—and for flower boxes, garden furniture, and all concrete exposed to severe action of water, frost, and wear.

Class B. Concrete mixed using 5½ gals. of water for each sack of cement when ordinary moist sand-gravel is used. (One sack of cement will make approximately 4 cu. ft. of concrete.) For water-tight concrete—water supply tanks, septic tanks, cisterns; for floors—water-tight floors, steps, porch floors, sidewalks, garage floors; for all concrete exposed to moderate action of water, frost, alkali, and wear.

Class C. Concrete mixed using 6½ gals. of water for each sack of cement when ordinary moist sand-gravel is used. (One sack of cement will make approximately 5 cu. ft. of concrete.) For walls and foundations, basement walls and floors (not water-tight); for foundations, shed walls, retaining walls, storage cellars, hotbed frames; and for all concrete protected from action of water, frost, and alkali.

Class D. Concrete mixed using 7½ gals. of water for each sack of cement when ordinary moist sand-gravel is used. (One sack of cement will make from 6 to 7 cu. ft. of concrete.) For mass concrete, engine foundations, foundation footings, heavy foundations below ground. To be used only when low strength is necessary.

Since the amount of water used with a given amount of cement controls the strength of the concrete, it is important that the amounts of water and cement used

in each batch be measured carefully. The amounts of water to be used in making concrete of different classes is stated in gallons of water per sack of cement. In order to make concrete of the desired class, it is necessary to provide a convenient method of measuring.

The average mixer will mix a batch based on from ⅓ to ½ a sack. A measuring box may be

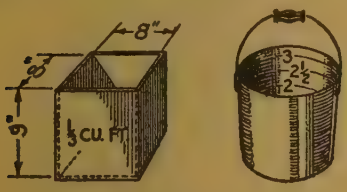


Fig. 13. Measuring box for cement and a marked pail for water.

made of wood or metal and should be 8 by 8 by 9 in. inside measurements to hold ⅓ sack (Fig. 13). A measure to hold ½ sack must be 9¼ by 10¼ in. inside measurements.

Use a common 3-gal. bucket with the inside marked so that measuring may be readily done. To do this place two quarts of water in the bucket and mark the water level. Add a second two quarts and again mark it. Continue in this manner until all three gallons are marked.

Suppose that Class A concrete is desired and the mixer will only mix ⅛ sack at a time. (1) Class A concrete requires 4½ gals. of water. Measure out 1½ gals. of water (⅓ of 4½ gallons) and empty into the mixer. (2) Measure out ⅓ sack of cement, compacting it by tapping the sides of the measure, and empty it in the mixer. (3) Shovel in sand-gravel until the mixture reaches a quaky, jellylike stiffness. (4) Allow the mixture to mix from 1½ to 2 minutes after all materials are in the machine. The mixture may be made more stiff or moist by adding more or less sand and gravel. *Always use the same amounts of water and cement.*

In mixing concrete by hand it is necessary to mix the cement and sand-gravel first. It generally requires a few trial batches in order to obtain the desired consistency. To do this, mix about 3 or 4 cu. ft. of sand-gravel with water as required for the class of concrete desired. If the mixture is too wet, add sand-gravel until the correct consistency is obtained. In this manner the amount of sand-gravel will be determined for future batches.

How to Clean Tiles

To remove cement and plaster from tile floors, first scrape off as much as possible and then apply muriatic acid in the proportions of one part acid to ten parts water. Add the acid slowly and cautiously to the water and handle the mixture with care.

Rub the marks with a rubbing

stone or an oilstone such as is used for sharpening tools. The oil with which the oilstone is impregnated will have no effect on the tiles. Work quickly, do not allow the acid to remain too long, and wash it off very thoroughly.

This acid solution is excellent for brightening brick mantels and other fixtures. The surface can be scrubbed with a stiff brush.

Repairing Building Tile

As hollow tile has less bonding surface, the mortar should be made a little richer. Be sure to include some slaked lime in all masonry mortar. A mortar made from 1 part cement, 3 parts screened sand, and ½ part lime will be found satisfactory. This mortar is also suitable for brick.

Tile is excellent for hotbed frames. A top layer of concrete should be provided for placing the bolts which are to hold the frame down.

It is best to plug the open ends of tile walls to seal the cells within the wall and insure durability.

Repairs to Metal Work

Just as the handy man has sometimes to play the part of a mason, he also has to act as a machinist and tinsmith in order to make repairs which involve metal work. The increased use of mechanical devices in the home makes a certain knowledge of metal work almost essential. Certainly every home owner should be adept at handling a soldering iron in connection with repairing metal.

Tools for Metal Work

It is only a step from simple soldering jobs to making other repairs with metal working tools, provided a few are available.

Every household should have either an electric soldering iron or a pair of soldering coppers. Coppers are sold by their weight per pair, and usually the weight stamped on each copper is that of the pair, or twice the weight of the individual copper. For household repairs a pair of 1- or ½-lb. coppers will be satisfactory.

A blowtorch is a convenient source of heat and will serve other purposes besides heating soldering coppers. The coppers can be heated, however, over a gas stove, in the flame of a hot water heater, or over a hot coal fire if a short length of iron pipe or a pan is placed on the coals to receive the coppers and protect them from the direct action of the sulphurous coal gases.

To prepare metal for soldering an assortment of files is necessary—at least a 10-in. mill file, and 8-in. round, half round, and flat files. Others can be added as needed.

For cutting, bending, and han-

dling metal it is desirable to have a pair of tin snips of good quality, a 6- or 8-in. pair of combination pliers, a pair of long flat nose pliers, 5 or 6 in., and a hack saw frame with blades. One or more cold chisels and a center punch will be found invaluable at times. It is taken for granted that there will be in the household tool kit a monkey wrench and a good sized pipe wrench. There will also be a brace, hand drill, breast drill, or electric drill for which it will be necessary to provide twist drills (or, in the case of a brace, twist drills for metal with bit-stock shanks) of whatever sizes are needed for the work in hand.

The ideal vise for home metal work is a swivel bench vise of machinist's type with steel jaws from 2½ to 4 in. wide. If the vise has an anvil attached, it will serve for light hammering or riveting; otherwise an old flatiron or a heavy piece of steel, such as a short section of a rail, will serve as an anvil.

Some of the tools which are included in every household kit—screw driver, saw file, hammer, and the like—will serve for metal work, although, of course, a ball peen hammer is better for metal work than an ordinary nail hammer.

With these tools the handy man will be well equipped for metal work unless he wishes to form threads on rods or tap threads in holes. In simple repair work this usually can be avoided, but sometimes it is essential to have a set of taps and dies on hand, as for example when some piece of household mechanism goes wrong and it would take considerable time to obtain a repair part from the manufacturer. The saving in making a single repair will sometimes pay for a set of taps and dies. A set of 3/16, ¼, 5/16, and ⅜ in. taps and dies, with the necessary die stock and tap wrench, will be sufficient for most repair jobs.

Hints on Soldering

Soldering today is not what it used to be. Even the housewife can repair a leak in a dish pan without any special bother.

Under most conditions only four things are important: The soldering copper must be kept well tinned on the point. A soldering flux or acid must be used to insure instant bonding between the molten solder and the metal to be soldered. The metal (aluminum excepted, as it cannot be soldered readily) must be clean and free from rust or grease. The joint must be heated above the melting point of solder.

Solder may be obtained in bars, a good grade consisting of half tin and half lead. It also comes in the form of wire, which is easily manipulated for the hard-to-get-at places. Wire solder also may be had with flux—either resin or acid—in-

side. This self-fluxing solder is especially convenient because the flux is applied to the joint along with the solder in just the right quantity to insure good work.

Another type of solder comes in semiliquid form in tubes and is excellent for use around the home or shop. It consists mainly of flux paste mixed with fine particles of solder.

Next in importance to the solder itself is the flux, which prevents oxidation and dissolves oxides during the soldering operations. Of all the plain fluxes in common use, probably the most convenient is one of the prepared soldering pastes. Paste flux can be used with either bar solder or ordinary wire solder.

Chloride of zinc, which can be obtained at a drug store, is an excellent flux; so is ordinary resin. Resin is especially desirable for soldering radio or electrical connections because there is no danger that corrosion will set in later on and there are no grease spots to spread and perhaps cause trouble. With acid fluxes there may be corrosion, unless care is taken to clean the joint with alcohol.

Soldering acids can be purchased, but it is a simple matter to make the commonly used stock solution or what is called "killed" acid. It is merely necessary to place pieces of pure zinc, such as scraps from the outside of an old dry cell, in a little muriatic acid. Add the zinc scrap until the bubbling action of the acid stops. Dilute the acid with a small quantity of water up to about one quarter of the volume and strain the mixture through cheesecloth. Keep it in a bottle or earthenware jar and use a glass or rubber stopper, or an earthenware cap, rather than a cork.

Soldering acid will instantly clean the tinned tips of a soldering copper. Its principal use, however, is to clean the metal to be soldered. It is applied with a small brush.

A block of sal ammoniac is useful for cleaning the copper point when it has become coated, and it also serves well as a flux, especially for copper.

Preparing the Copper

Before a soldering copper can be used, the tip must be tinned. Heat the copper until solder will melt quickly when touched with it. Put the copper in the vise and file the four converging sides until they are bright. Apply flux and rub the sides with solder while they are still hot. If a self-fluxing wire solder is used, merely rub it on at the

end of the copper. The tinning process can be made easier if the copper is rubbed on a common building brick upon which some powdered resin and bits of sal ammoniac have been scattered.

After some use the point may have to be retinned, especially if it has been overheated. That is one reason why it is important not to allow a copper to become red-hot. Wipe the point now and then on a rag to keep it clean.

It is better not to let the flame of a blowtorch strike the point directly; let it play on the body of the copper in the middle or near the larger end.

Repairing Leaks in Pans

Before attempting to repair a small leak in a pan or kettle, rub the spot around the hole inside the dish with emery cloth or other abrasive until bright. Place the hot copper under the hole to heat the metal. Rub the upper side with flux, then apply a drop of solder. If one of the solders containing flux is used, merely apply the solder. The solder should not extend below the hole. This repair will be permanent unless the kettle should run out of moisture on the inside; then the solder possibly will melt.

For larger leaks or spots, clean the lower side and cut a small tin patch to cover it with a liberal lap.

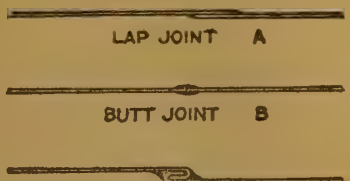


Fig. 14. Three types of ordinary soldered joints or seams.

Solder (tin) the lower side evenly, then apply the tin patch and heat it with the copper until it has been firmly attached or "sweated" in place. Next cover the edges with solder and later file the solder smooth.

So many kitchen utensils are now made from aluminum that it is unfortunate this metal is so difficult to solder. Special solders for aluminum are sold, but it is useless to attempt to use ordinary solder.

Many leaks can be patched successfully without solder by using household mending patches which are applied by means of small screws and are easy to use. These patches are very useful, and the handy man should always keep some in his kit.

How to Solder Joints

For most repair work a plain lap joint as shown at *A*, Fig. 14, is satisfactory. The solder can be ap-

plied to one or both sides of the seam. At *B* is shown a butt joint; it is not so strong as the lap joint but is neater for some work. Before the ends of the metal are butted together, they should be tinned thoroughly with solder and then solder should be applied liberally on both sides of the joint. The crimped joint at *C* is for seams which will be subjected to considerable strain. If large pieces are to be soldered in this way, it is advisable to have the crimping and as much of the soldering as possible done at a tin shop.

Radio and Electrical Joints

While the acid or other types of fluxes are suited for ordinary kinds of soldering jobs, resin is the only flux that should be used for radio soldering, according to radio authorities. The characteristics of this flux render it particularly suited to the bonding of electrical contacts, for it leaves a residue which is neither greasy nor acid. If you are using bar solder, simply use a piece of resin as you would any flux. For convenience the resin can be powdered or made into a liquid flux by dissolving it in denatured alcohol. If you are using wire-core solder for radio work, get the kind that has the resin core.

Cutting Slots in Thin Metal

A slot in thin metal often can be cut quickly by bending the piece around a wooden form held in a vise, as shown in Fig. 15, and using a hack saw. After the two long cuts are made, the piece is flattened

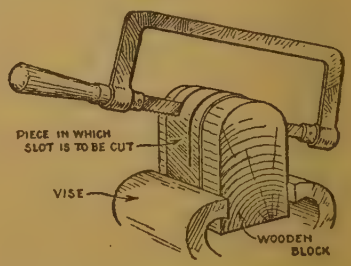


Fig. 15. Cutting a slot in thin metal with a hack saw.

and the ends of the slot cut with a cold chisel. The edges are then trimmed with a file.

How to Tint Copper Green

Copper used outdoors can be given the rich green tint that is caused ordinarily by two or three years' exposure to the atmosphere. Make a solution of 1 lb. of sal ammoniac and 5 gals. of water, allow it to stand for a day, and apply it with a brush. Twenty-four hours later, moisten surface with water.

CHAPTER X

SCREENS, STORM SASH, AND WEATHER STRIPS

THE making of window screens is easily within the reach of amateur skill. Indeed, screens are so simple and so familiar to all that extensive directions for making them are hardly necessary.

They are usually made of white pine, which is an excellent wood for the purpose and pleasant to use, but fir and other softwoods will do very well.

Adjustable screens may be bought at any house furnishing store and will not be described here, as the home worker can more profitably make other varieties which are at once more durable and satisfactory.

The outside full length screen is the most popular type. It is usually hung by means of screen hangers (see Fig. 1) to the outside casing at the top of the window frame and is held in at the bottom by means of one or two hooks and eyes, the hooks being set into the lower rail of the screen and the eyes into the window sill. The screen fits tightly in a sort of rabbet formed by what is called the blind stop and the inside edges of the window casing, except at the lower edge where it rests directly on the window sill.

This type of screen has a great advantage in that it permits both the upper and the lower sash to be moved freely.

As made commercially, the better grades of these screens are 1⅛ in. thick. Their outside surfaces therefore come flush with the casing of the window, which is ordinarily of that thickness. The home worker will do well to obtain stock equally thick, although ⅞-in. wood is often used. The thinner wood will serve well enough as there is no great strain involved, but it does not make as stiff a screen and never looks quite as neat when in place.

A full length screen should have a cross rail opposite the meeting (center) rail of the sash. This rail, the top rail, and the two sidepieces or stiles should be at least 1½ in. wide and the bottom rail at least 2½ in. wide. The larger the frame, the wider the stock should be.

Sometimes outside screens are made only half length, that is, from the sill up to the meeting rail of the sash. The obvious objection is that the upper sash cannot be

opened without letting in insects. The advantages are that the half screens are lighter to handle, allow more light to enter the room since they cover only half the window,

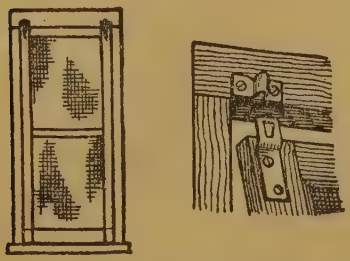


FIG. 1. Full length window screen and one standard type of hanger.

and may be removed easily when the windows require washing.

When half screens are used it is more usual to place them on the inside of the room and provide them with tracks or runners as shown in Fig. 2, so that they can be removed by raising them as far as they will go, or until they are clear of the upper ends of the tracks.

Other types of screens are occasionally encountered and sometimes, especially in old houses, the home worker will have to modify standard methods to suit unusual construction.

For example, if the window frames have no blind stops, a full length outside screen will have to be made at least 1 in. wider and higher than the opening so that it can be applied flat against the outside faces of the casing. Then it can be held by means of screw eyes and screws as shown in Fig. 3.

SPECIAL WAYS TO HANG SCREENS

Sometimes on upstairs windows, especially on the third floor beyond the reach of ordinary ladders, the home worker does not care to climb out on the window sill in order to screw the screen hangers in place at the top of the window frame. A substitute method of attaching screens —and, of course, storm sash also— and one that can be accomplished from the inside of the room is as follows:

With a hack saw cut two tenpenny or larger nails so as to make two steel pins 1¾ in. long, one end of each being pointed. Drill holes in the top edge of the screen about

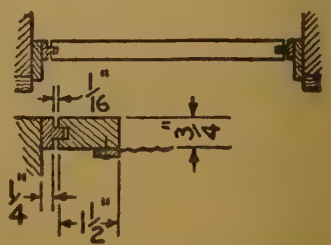


FIG. 2. Section of inside sliding screen with a runner or track.

3 or 4 in. from each side to receive the pins tightly. Make the holes about 1 in. deep and drive the pins in so that the pointed ends project about ¾ in. from the upper edge

of the screen. Now push the screen up into place as far as possible (it will be necessary to hold the screen outside the window while doing this) in order to make marks in the edge of the upper casing with the pins. Lift the screen inside again and at the two points marked in the

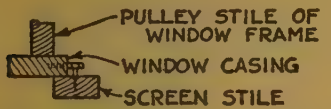


Fig. 3. How to hold a full length screen on window frames having no blind stops.

edge of the casing drill holes that will allow the pins to fit easily into them. Now put the screen in place once more and it will be held at the top by the two pins. Hooks and eyes at the bottom will retain it at the bottom.

This is a simple and neat way of applying any full length outside screens, but care must be taken in removing them because as soon as the bottom is pushed out, they will fall unless firmly held, unlike screen and storm sash held by regular hangers.

A screen also can be held by boring holes through the sidepieces or stiles from the inside to the outside edge and on into the window casing while the screen is being held in place. A loose-fitting nail can then be slipped into the holes so as to lock the screen in place. Six or eight nails to a screen will serve.

Turn buttons applied on the window casing will hold screens in place when other means cannot be used conveniently.

Methods of Constructing Screens

In the actual construction of screens the first step cannot be taken until you decide what type of joint you wish to use. This is mainly a matter of personal preference, as no great strength is required. A common nailed joint is strong enough, especially if reinforced with angle irons. Splitting can be avoided at the end joints by drilling holes through the stiles and using finishing nails—not common flat-head nails.

The notched butt joints shown in Fig. 4 are among the most popu-

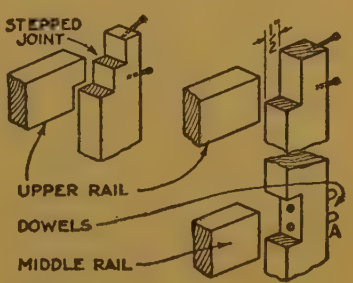


Fig. 4. Three kinds of notched butt joints for making frames.

lar with amateurs. They require little skill except accuracy in cutting pieces to correct lengths and marking the location of the notches

carefully. Usually the joints are fastened with eightpenny finishing nails but they also can be held with dowels inserted as at *A*, Fig. 4.

With a good miter box it is a very simple matter to make miter joints (Fig. 5). Before nailing them together drill holes or use an awl to make holes for receiving the six-penny finishing nails—two from one side and one from the other. Note that the nails are slanted a little. First nail together diagonally opposite corners and then assemble the two pairs. Corrugated fasteners also can be used; drive one in the face of the joint on one side and two in the opposite side.

Glue is not often used for home-made screens, but it will strengthen miter joints materially. It should be of a waterproof variety. Casein glue is excellent for this purpose and most convenient to use. Strange to say, the glue is a by-product of milk; and it comes in the form of a powder and requires merely to be mixed with water. Whenever glue is mentioned for use in outside woodwork, it will be understood that a waterproof variety is intended. In the absence of waterproof glue, white lead-in-oil paste may be used in the joints.

Do not forget in nailing miter joints to hold the pieces in the vise as shown as at *A*, Fig. 5. By placing the pieces in this way, the upper one will be drawn into place as the nails are driven home. A miter joint can be doweled instead of nailed, especially if a doweling jig is available, but more careful workmanship is required.

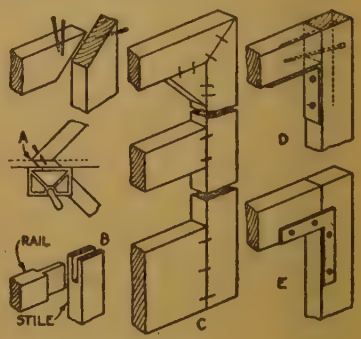


FIG. 5. Screen joints may be nailed, held with corrugated fasteners, and reinforced with angle irons or corner plates.

Commercial screens of good quality are usually fastened with mortise and tenon joints. An open mortise joint may be made by hand as shown at *B*, Fig. 5, but it is a better project for the amateur mechanic who has a motorized home workshop. If there is a mill near by, the rails and stiles can be cut to the exact lengths (⅛ in. less than the actual opening to allow for the paint and still give a little freedom in the fit) and taken there to be machined to a push fit. Then they can be taken home again and driven

together with waterproof glue. Care must be taken in this as in all other cases to see that the screens are square before the glue hardens.

Butt joints, as well as miter joints, may be fastened quickly and conveniently with corrugated fasteners, which can be obtained in all well-stocked hardware stores. The drawing at *C*, Fig. 5, shows how the joints are made and indicates a method of bracing large frames with wooden blocks at the corners. Joints with corrugated fasteners are very easily made and quite strong.

Square butt joints may be reinforced with inside angle irons as at *D*, Fig. 5. A face angle iron or L-shaped mending plate *E* also may be used, but it should be on the back where it will not interfere with the wire cloth and the molding.

Laying Out Screens

When you have decided which type of joint to use and have your lumber on hand, you will be able with a little practice to lay out screen frames very quickly and accurately. The stock, as previously suggested, will be approximately 1⅛ or ⅞ in. thick by 1½ or 2 in. wide for the stiles and cross rails; and 1⅛ or ⅞ by 2½ or 3 in. for the bottom rails of all except the smallest screens. These dimensions are not hard and fast; your lumber dealer will have in stock suitable material for making screens and will know what is customarily used by the carpenters in your own neighborhood.

Figure the number of lineal feet you will need and get the same number of feet of screen molding, which is used to cover the raw edges of the screen cloth. Your lumber dealer may have a special screen molding for this one purpose or he may give you ½-, ⅝-, or ¾-in. half-round molding, which is often used and will be quite satisfactory.

The safest way to lay out screens is to make a measuring rod from a light strip of wood. Cut it the exact length of the screen and mark on it the exact width; or, better still, cut a second piece to represent the width. Try these measuring sticks in place to make sure they are accurately cut.

Unless you are prevented from doing so by the type of joint you select (as in the case of miter joints), cut the stiles roughly 2 in. longer than necessary and do not remove the surplus 1-in. length at each end or "cut off the horns," as a carpenter would say, until the frame is complete and ready to be fitted. The projecting ends of the stiles protect the frame from damage and lessen the likelihood of splitting if the corner joints are nailed.

Another method of laying out screens which eliminates the possibility of error in measurements is as follows:

Cut two sidepieces or stiles to suit the window frame. Square one end of the three pieces which are to make the top, bottom, and middle rails. Lay them on the window sill with the squared ends resting against the right casing. Now mark them for length by deducting the exact width of the two stiles; that is, mark on the rails the distance across the window less the combined width of the sidepieces. The stiles then are marked for the center rail at the height of the meeting rails of the window, and the parts nailed together with plain butt joints as at *D*, Fig. 5.

Screen Door Frames

Before the subject of covering the screens is taken up, a word or two should be said in regard to screen door frames. For them it is best to use dry straight white pine 1⅛ in. thick. The stiles and top rail may be 3½ or 4 in. wide, the middle rail 3½ in. wide, and the bottom rail 7½ in. wide, although the dimensions may vary to some degree.

The joints may be doweled as at *A*, Fig. 6, or mortised as at *B*. After the mortised door is glued, drive wedges into the saw cuts from the edge of the stile to make the outer end of the tenon wider; this will increase greatly the holding strength. Probably the dowel form will be preferred, as it may be more easily made; and with ½ by 1½ in. corrugated iron fasteners for additional strength, the construction is amply strong.

The faces of the door—and, of course, of all screens—should be

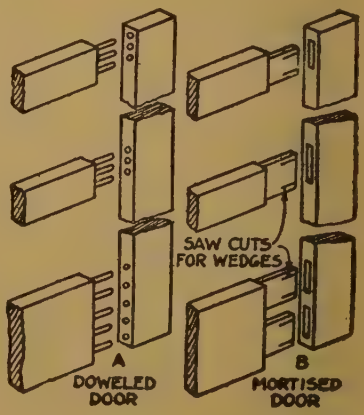


Fig. 6. How to assemble a screen door frame with doweled or mortised joints.

smoothed and sandpapered. The iron fasteners must be first driven well in or they will interfere. A little water dropped at each fastener to swell the wood will make it less conspicuous. Putty and paint will practically conceal the fasteners.

Choosing Wire Cloth

Naturally, after going to the pains of making good screen frames, a home worker would be shortsighted to cover them with anything but a high grade of wire insect screening. A good grade of bronze wire cloth, for example, will last almost in-

definitely without being painted or oiled, whereas a cheap grade of iron wire cloth will rust in a season or two unless painted with the utmost care—and painting screens is an irksome job at best.

Wire cloth comes in a large number of widths so that it is always possible to obtain a width that can be used without much waste. The better grades are obtainable in widths from 18 to 48 in. by 2-in. steps.

The fineness of the mesh varies from 12 to 18, the figures designating the number of wires per lineal inch. Screening of 14 mesh is regarded as generally satisfactory; the choice usually is between 14 and 16, the latter being a little finer.

Because of their obvious advantage in durability, screens covered with bronze, copper, and other rust-proof alloys are being used more and more. Next to them in rank are the better grades of galvanized insect screenings. If the galvanizing is of a high grade, the screens are reasonably durable, especially if they are painted at intervals. The least expensive screen cloth is made of steel wire painted during the process of manufacture. In dry climates this type of screening has proved satisfactory when given good care and kept well painted.

How to Stretch Screens

The stretching of screen cloth often gives the amateur difficulty, and various methods have been devised to make the task easier for him.

Do not overlook the fact that wire cloth is usually placed on the outside or weather side of an outside screen and on the inside of an inside screen.

First, cut off a piece a little longer than the opening of the screen frame. Have a supply of common No. 4 carpet tacks; these are 7/16 in. long. For bronze and copper screenings the tacks preferably should be copper. Small double-pointed tacks are preferred by some mechanics but it is not always easy to obtain them small enough.

The wire can be stretched as tight as necessary without any artificial aid. One method is to tack first of all one side, beginning at the center and working to the ends. Use plenty of tacks. Now pull the opposite side and tack it, stretching the wire as tightly as possible. Next, tack one end, but do not stretch it very much. Finally, stretch and tack the other end.

While this method sounds simple and in the hands of many men will give as tight a screen as one could wish, amateurs often find it helpful to use one of the following ways to obtain artificial aid in the process of stretching the wire.

1. Nail a strip of wood firmly to the bench and tack the end of the wire cloth to it. Butt one end of the screen against this strip and elevate the far end of the screen on another strip of wood. Tack the wire at the elevated end of the screen, pulling it taut as possible. Then remove the support and lower the frame into a horizontal position. If this does not stretch the wire sufficiently, thin wedges can be driven between the screen and the end strip on the bench. Having stretched the screening in this way, tack the remaining sides.

2. Place two frames together on the table or the floor with their outer ends elevated about 1 in. on blocks as shown in Fig. 7. The netting is cut long enough to cover both frames and tacked at the outer or elevated ends. The blocks then are removed, the frames pressed down flat, and the tacking finished. This insures that the wire will be stretched evenly and allows free use of both hands for tacking.

3. Obtain screening at least 1 in. wider than the length of the rails, to lap over the frame ½ in. or more on each side for tacking. Cut a piece 1 in. longer than the opening with old shears or tin snips or by drawing a knife through the weave. In tacking the wire, fasten one side and end on perfectly square, with the edge ½ in. from the opening; draw it tight and allow the extra screening, if any, to extend over the other sides. A piece of ¾ in. thick wood is then placed ½ in. away from the remaining stile on the underside of the screen. The fingers are placed on the screen over this strip and the thumb is pressed on the edge of the stile. This gives enough tension while tacking the remaining side and end of the wire.

4. If a long screen is to be covered, place a ¾-in. strip under each end, spring the stiles down until they rest on the table or floor, and hold them there by any convenient device. Tack on the wire and allow the frame to straighten; then the wire will be tight.

Which of these methods to choose is something for the individual to decide for himself, as the opinions of mechanics differ.

Applying Screen Molding

The surplus wire is cut off with a sharp pocketknife close to the line of tacks. Then the raw edges of the wire and the tacks are covered with screen molding or half-round molding. While this molding often is only ½ in. wide, it is better for the amateur to use a molding ⅝ or ¾ in. wide because it covers more of a margin and allows more room for tacking the wire cloth.

The molding is mitered at the corners. Perhaps the simplest way for the amateur to apply it is to cut pieces about 1½ in. longer and wider than the opening and fasten

them on with ¾-in. brads everywhere except toward the corners, which are left loose, one piece overlapping the other. A thin saw is then used to cut through the molding diagonally at each corner. A piece of very thin wood can be

FIG. 7. One method of placing two screens together in order to stretch the wire.

slipped underneath the molding before the sawing is done, if desired, to protect the screening from possible damage. Since both moldings are cut at one time, the corner joint is bound to fit accurately. Finish nailing the corners.

To save time it is permissible to consider a screen with a center rail as having only one opening and to carry the screening across the rail, just as if the rail did not exist. However, a few tacks should be placed along the center of the rail and a piece of the screen molding should be nailed across it. This central molding can be whittled with a pocketknife at the ends to fit snugly against the molding on the stiles.

If only a single screen is to be made or if for any reason it is impossible to obtain a suitable screen molding, pieces 5/16 in. thick may be sawed from the edge of a ½-, ⅝-, or ¾-in. board, and after being planed, used instead of the molding.

How to Fit Window and Door Screens

When window screens are made accurately to fit the windows they are intended to be used on, little additional fitting is required. The edges can be planed as necessary to make a neat fit and the lower edge can be beveled to suit the sill. Do the fitting before the screens are painted, if possible, but allow enough for the coats of paint. Screens should fit neatly but not so tight that there will be any danger of their sticking and perhaps damaging the corners of the casings when it is necessary to take them down in the fall.

Fitting a screen door usually requires a little more care than fitting a window screen.

Lay the door down on a pair of saw horses or other supports and cut off the stile projections ("horns" or "lugs," as a carpenter would call them). Stand the screen against the opening and note the width. Plane, or ripsaw and plane, the door so it will just slip into the opening.

With the door in place against the stops, wedge up the bottom and one side, and scribe the top rail to the head jamb, using scribers or a compass. Saw and plane to the line and test in position. Then fit the bottom of the door, allowing as little clearance above the floor or linoleum as possible, as otherwise flies will crawl under.

Having obtained a good fit, with the edges of the door beveled sufficiently to clear, wedge the door tightly against the hinge jamb by means of shingle points or other broad wedges, leaving proper clearance at top and bottom.

Measure up from the bottom 11 in. and down from the top 7 in., and put on the spring hinges. Screen hinges may be of any common spring type, or plain steel butt hinges may be used with a separate spring. To mark for screw holes, hold the hinges firmly in place and trace the holes with a lead pencil. Drill small holes to start the screws, or if the casing is of softwood, punch them with a nail set. Screw on the hinges and remove the wedges.

Insufficient seasoning of the material of which the door is built often results in the stiles' springing until the center of the hinge stile strikes the stop, so that the door will not close. An effectual remedy is to put another hinge at the center, which will keep the stile straight.

Put the handle about 3 ft. from the floor, and the hook eye opposite. The hook should be attached to the frame; otherwise it may flip around when the door swings shut, preventing it from closing properly and marring the casing and jamb.

Reinforcing Wire Cloth

Children are apt to push against the screen cloth covering the lower part of a door and cause it to bulge in an unsightly manner. This can be prevented by covering the screening with heavy galvanized wire mesh or hardware cloth with openings ¼ in. square or larger. This can be applied directly over the fine mesh and the edges covered with the regular screen molding.

It is an advantage to cover cellar screens with the same heavy mesh, especially if there is any danger that rats will attempt to enter through the screens or if the screens are so located that they are subject to accidental damage.

Screening an Open Porch

It is not necessary to enlarge upon the advantages of a screened-in porch, but the fact that the screens are larger and made of wider stock seems to intimidate many home workers, or more families would enjoy them. The making of the screens involves no difficulties not dealt with previously.

In planning the frames, decide whether the screens are to be placed inside, outside, or between the posts. In any case, the screens should stand plumb, so if the screens are placed on either side of the posts, usually a filler strip

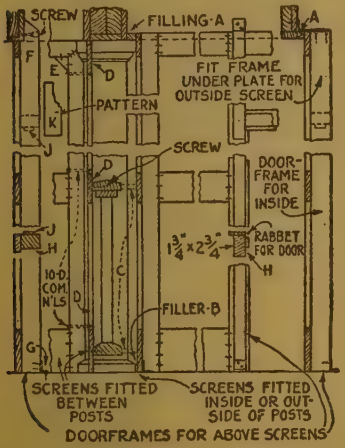


Fig. 8. Condensed drawings to show the two principal ways of screening an open porch.

must be fitted at either *A* or *B*, Fig. 8, or both. The top is fastened with screws, hooks and eyes, or angle irons, and the bottom by angle irons. It may be necessary to support joints between posts with a filler as shown by dotted lines *C* and fasten them with hooks and eyes.

Another popular but more difficult method is to fit the screens between the posts and against the rails as at *D*. Porch screens of this type should be made of material at least ⅞ by 2¼ in., reinforced at *E*, because fitting around the capital may weaken the joint.

The door frame should be placed as shown at *F*, fastened at the top with screws and at the bottom with angle irons *G*. The section of the door frame depends upon the way the screens are made and fitted, but usually 1¾ by 2¾ in. stock as at *H* will give sufficient rigidity and be adaptable to any type of screen. The ½ by 1½ in. door stop *J* may be nailed in place after the door is fitted.

Measure the openings or bays between the posts accurately, allow for the width of the screen stiles and for the ½-in. lap of the screen upon the stiles, and estimate the width of the wire cloth needed. More than 48 in. in width is not advisable. Most porch bays range between 6 and 10 ft. and each will require either two or three screens.

Place the middle and bottom rails of the screens and doors to conform to the porch rails. The joints may be fastened by ½ by 1½ in. corrugated fasteners placed on both sides of each joint and not more than 2 in. apart. Be sure they are not located so they will strike each other in driving.

Fit the frames in their places. If the frames are to fit between the posts, make a pattern as at *K*, Fig. 8, that corresponds to the contour of the moldings, and cut

each screen frame to fit it. Nail stay laths diagonally across the back of each frame to hold it in shape. The posts may not all be plumb or the floors all level, although usually the frame may be sprung to fit.

One way to fasten the screens is to drill ¼-in. holes through the frames, if they fit between the posts, and into the posts to receive loose-fitting nails. Do the same for the middle joint between the posts. When the frames are in place, 3-in. barrel bolts may be used to hold the top of the frame, if the necessary holes are bored in the plate soffit of the porch.

Special fittings for porch screens are sold by the larger hardware stores, including flat couplings and corner couplings for fastening screen sections together. Methods of fastening screens to brick walls and the use of brass screw holes are discussed in Chapter I (31).

The first or priming coat of paint and often the second coat may be spread on the frames and moldings before the screening is fitted. The moldings can be tacked in place temporarily while the painting is being done, or they can be painted separately before being cut up. After the wire is on, another coat of paint can be applied, should it be necessary. If galvanized or painted steel wire cloth has been used, work the final coat well under the edges of the screen molding.

Quick-Change Doors

Much can be done to eliminate certain annoyances connected with the semiannual changing of screen and storm doors. Remove the old hinges from the door and the casing. Whittle wooden plugs, dip them in glue, and drive them in any old screw holes and putty all other unsightly holes and small imperfections or fill them with commercial wood paste, and paint the surfaces of both door and doorframe.

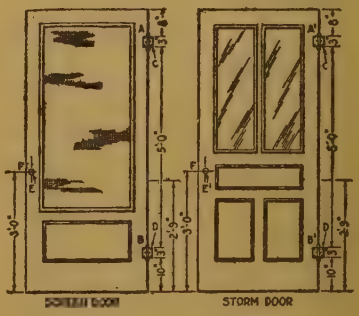


Fig. 9. When fitted with loose-pin hinges, storm and screen doors can be quickly interchanged.

Purchase two pairs of 3 by 3 in. loose-pin butt hinges and two suitable duplicate catches. Place the hinges on one door, say the screen door, as at *A* and *B*, Fig 9. Hold the door in its place in the opening with wedges and fasten the sides *C* and *D* of the hinges to the doorframe.

Fit a catch at *E* in the door and cut the striker plate in the door-

frame at *F*. Fasten a long spiral spring to the inside of the door and to the doorframe. Remove the pin from each hinge, release the spring from the screw eye on the door, and set the door aside.

Place the parts A^1 and B^1 of the other hinge into parts *C* and *D*, which are already fastened to the doorframe, and drop the pins into the hinges. Wedge the storm door into position in the doorframe and fasten the hinge members A^1 and B^1 to it with screws. Place a catch at *E* so it exactly engages the striker in the doorframe at *F*. Turn in a screw eye on the inside of the door to receive the end of the spring.

Now, instead of spending several hours twice a year in assembling tools and accessories and in changing screen and storm doors, simply remove the spring from the eye on the inside of the door already hung, lift the pin from each hinge, slip the other door in position, drop the pins into their places in the hinges, and put the end of the spring in the screw eye on the inside of the door. Fifteen minutes' work and the job is done.

The released door should be set away so it will stand perfectly straight, or it may develop a twist which will prevent it from closing properly and be impossible to cure.

Another solution of the same problem is to make a double duty screen door as in Fig. 10. We will assume that the door opening requires a door 3 by 7 ft., which is a stock size. From kiln-dried white pine or other suitable lumber, prepare two stiles 1⅛ by 5⅛ by 85 in., one top rail 1⅛ by 5⅛ by 26 in., one bottom rail 1⅛ by 9⅛ by 26 in., and one middle rail 1⅛ by 3½ by 26 in. The allowance of 1 in. in length on the stiles and of ⅛ in. in the width of the top and bottom rails should extend beyond the actual size of the door to provide for its final fitting.

Lay out the position of the rails and make the joints, preferably with ½-in. dowels; if ⅜-in. dowels are used, there should be more of them. Glue and clamp up the door, being sure it is square. Then smooth and sandpaper it.

Prepare the quarter-round molding *O* 5/16 by 5/16 in. by 9 ft., miter around one side of the edge of the panel opening, and fasten with ¾-in. No. 17 brads. Make a panel ⅜ by 11½ by 26 in., smooth and sandpaper it, and fasten it in place with quarter-round molding on the other side of the panel. The stop strips *N* for the large opening are 5/16 by 1 in., of which 15 ft. will be needed.

For the screen frame are needed two stiles 1⅛ by 1½ by 55 in. and two rails 1⅛ by 1½ by 26 in. Assemble them with miter joints. Get out screen strips 3/16 by ⅝ in. by 15 ft. Stretch wire netting, preferably of copper, bronze, or other nonrusting wire, and fasten with 4-oz. cop-

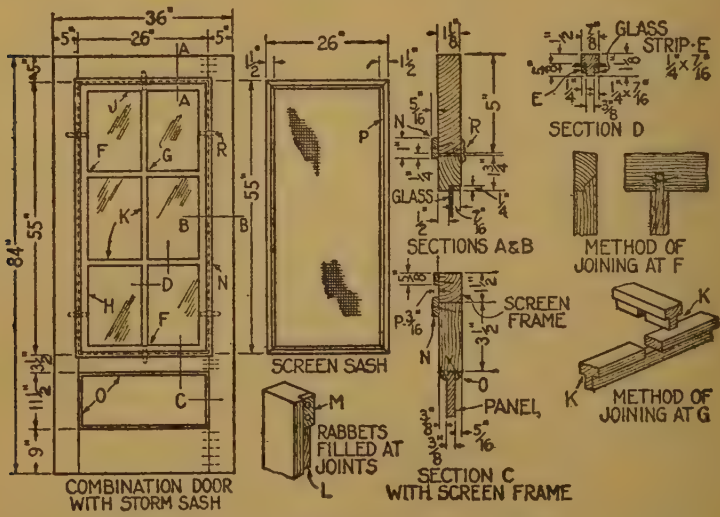


FIG. 10. The front of the combination door with storm sash in place; the screen frame; and cross sections and details showing the construction.

per tacks. Fit the screen strips with miter joints and fasten with ¾-in. brads.

To make a storm sash with lights of glass, as shown, cut two stiles *H* 1⅛ by 1¾ by 56 in. (1 in. allowance in length), two rails *J* 1⅛ by 1¾ by 22½ in., and one muntin strip *K* 1⅛ by ⅞ in. by 9 ft. Rabbet these ¼ by ⅝ in. as shown in the two details marked *K* and *L*.

Mark the position of the top and bottom rails on the stiles; glue fillers in the rabbets, as at *M*, to receive the rails, and proceed to assemble the storm sash with dowel joints. Be sure the sash is square and true. Fit the muntins as in details *F* and *G*. Smooth and sandpaper the sash. Get out glass strips *E* ¼ by 7/16 in. by 22 ft. and fit them to the glass openings with butt joints. Cut the glass to fit and fasten the strips *E* with ⅝-in. No. 18 brads.

If a priming coat of paint is applied before the glass and screening are in place, considerable time will be saved. After painting, fix six brass or iron buttons *R*. The door is hung with the buttons on the inside.

How to Care for Screens

Nothing so adds to the general appearance of dilapidation as unpainted screen frames and sagging

and broken screening, yet these can be remedied with a little work, and almost entirely prevented with a little thought and care.

When the screens are removed in the fall, gather loose screws, hooks, buttons, and attachments and tie them securely in a piece of canvas. Fasten the bundle to the handle of one of the screen doors.

See that each screen is marked for ready identification. One way is to cut a Roman numeral in the edge of each screen with a ½ in. wide chisel and a corresponding numeral on the edge of the window casing opposite where the screen has been marked (Fig. 11). Another method is to obtain metallic number tacks, which may be purchased cheaply at any hardware store. Even marking the bottom of each screen with a heavy colored marking crayon will serve as a makeshift.

When the screens are down, brush them well outdoors. While doing this, note carefully whether any of the screens, if covered with painted or galvanized wire, have a brown or slightly rusty look. These should be placed at one side for painting at the earliest opportunity; the wire may be past service if left until spring.

Asphaltum varnish thinned with turpentine may be used for painting the wire, or regular black or green screen enamel. Boiled linseed oil with a little turpentine added, together with sufficient lampblack to color it black, is very easy to use, especially if applied with a small piece of close-grained sponge instead of a brush. This mixture can be used on galvanized screening one year and spar varnish thinned with turpentine can be applied the following year, and so on through the life of the wire. With bronze and copper screening, this labor is saved.

If any tears or holes are seen, they may be repaired readily, if not too large, with small screen wire patches, the edges of which are unraveled and caught in the screen, as shown in Fig. 11. Often a screen may be repaired by sewing a neat patch through and through with a piece of the screen wire.

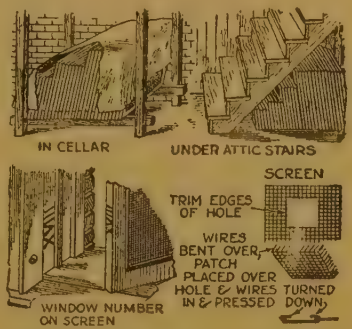

IN CELLAR
UNDER ATTIC STAIRS
SCREEN
TRIM EDGES OF HOLE
WIRES BENT OVER, PATCH PLACED OVER HOLE & WIRES IN & PRESSED
TURNED DOWN
WINDOW NUMBER ON SCREEN

FIG. 11. How to mark and store screens and a method of patching small holes.

Usually it is impossible to repair a "run" or tear along the line of tacks. In such a case, even if the wire is otherwise in good condition,

it is best to put on new wire.

To remove old wire, take off the molding covering the tacks, pull out a few tacks at one corner only, hold down the frame firmly with the left hand, and catching hold of the loosened wire at the corner, give a sharp upward pull. The entire piece of netting will come off. Remove all remaining tacks. Lay the new piece of wire on the frame, and fasten as before described.

Metal braces for sagging doors, spring hinges, corner irons, latches, and stops to prevent doors from banging are usually obtainable at hardware stores.

The lower panel of a screen door may be filled with a thin board, or a wall board panel can be set in with strips of wood to resist the onslaught of children, dogs, and cats. A hand piece ⅜ by 3 in. fastened from stile to stile about 4 ft. 6 in. from the floor will reduce the damage done by careless persons who push against the wire netting, which soon pulls the wire from its fastenings.

Temporary screens, as for a camp, may be made by cutting woven cloth screen about 6 in. larger each way than the opening between the casings of the window to be screened. Wind the edges around ⅜ by ⅜ in. strips of wood of a length to fit loosely in the opening, and drive small brads through the strips into the edge of the window casing.

How to Make Storm Sash

Storm sash, or double windows, on the cold sides of the house, will increase your winter comfort and make possible a surprising saving in fuel. Usually they are bought

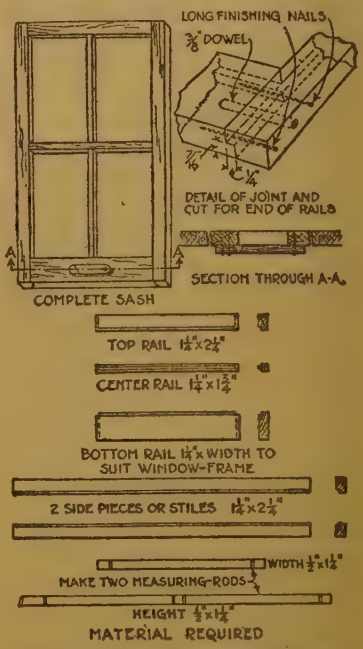


Fig. 12. A storm sash of simple construction and its various parts.

ready-made, or it is regarded as a carpenter's job to make them, but the method discussed here is so simple and effective that any man who is at all handy with tools may safely undertake the work. White pine 1⅛ in. thick may be used.

The only tools needed are a crosscut saw, ripsaw, try-square, hammer and nail set, brace and ⅜-in. bit, a fillister, rabbet, or dado plane, a sharp 1-in. chisel, and an adjustable iron jack plane. Glue, 3½-in. finishing nails, and ⅜-in. dowels will be necessary; and a miter box will be a great aid in making square, accurate cuts. You will be able to make use of a compass saw and hand screws if they are available.

First cut two measuring rods to fit neatly in the opening where the sash is to go.

Lay out the rods as shown in Fig. 12, making the center rail come opposite the meeting rail or check rail in the regular sash. Have all lights of glass the same size and let the bottom rail be wide enough to make up the difference. Usually that will be about 5 in.

Cut all pieces to the widths and lengths as marked on the rods. Be sure the rails are square and true. The rails should be cut to the longer of the two marks on the width rod, that is, 4 in. less than the full width of the sash.

With the rabbet plane cut a rabbet ¼ in. deep, working all the pieces as shown on one edge only, except the center rail, which is rabbeted on both edges. Also, with the plane bevel the bottom edge of the rail and the lower end of each stile to the angle taken from the window sill.

In the ends of each rail make a square cut as illustrated in the perspective detail the exact depth necessary (it will be about $1\frac{1}{16}$ in.). Carefully make a line on the end grain and remove the loose wood with a chisel or a fine saw. Rail and stile will then fit neatly together.

Assembling the Sash

The sash is now ready to be nailed and doweled together. The joints must be held with hand screws or some other device as the nails are being driven. Drive two of the long finishing nails at each joint near the edges of the top and bottom rails, and sink them in deep with the nail set.

Now make sure the sash is perfectly square. It is best to nail on a brace to hold it true temporarily. Next bore a ⅜-in. hole between the nails in each joint. If a machinist's drill is used for this, no harm will result if it strikes a nail. Put glue in the hole and drive in a dowel that is 1 in. longer than the nails.

The two vertical bars or muntins as shown in Fig. 12 may be made from pieces left over, fitted in tightly, and nailed with 1-in. brads.

The bottom ventilator is best cut out by boring a hole with an expansive bit as large as is desired at each end and cutting the slot with a compass saw.

The cover is put on the inside and is about 3 in. longer than the vent and ¾ in. wider. It is made in one piece and then cut at the angle shown, the small piece being bradded on to the sash, the long piece swinging on a screw.

A ventilating light may be made in any type of storm sash by making a mitered frame ½ in. thick and 1 in. wide, rabbeted to hold glass, and the same size outside as a light of glass in the storm sash. Remove a light of glass and in its place hang the framed glass to swing out.

Fitting and Hanging Storm Sash and Doors

As storm sash are usually hung on the same hangers used for screens, they can be swung out a little at the bottom for ventilation, provided a suitable fastener is obtained. A variety of styles are sold for this purpose.

If the handy man does not care to make storm sash and doors, he will find them at any building supply house and has only to fit them and fasten them in place.

Usually the fitting will consist only of sawing the horns off, beveling the bottom to fit the window sill and the top to shed water, and cutting around any obstruction, such as blind hinges and locks. Plane the edges of the sash to make them smooth and paint with two coats of white lead and oil or high-grade outside oil paint. Be sure each sash is clearly numbered.

Applying Weather Strips

Interlocking metal weather strips have been developed to such a degree of perfection that they are a real economy in a cold climate. They prevent almost completely the leakage of air around window sash and thus reduce one of the principal losses of heat. Many prefer metal weather strips to storm sash both because of their efficiency in stopping the leakage of air and the fact that they require no attention once they have been installed.

Unfortunately, the handy man cannot very well install any of the more elaborate types of metal weather strips. They are almost invariably put in by experts who have special tools to make the work easier, although it is always a considerable task and therefore expensive.

In spite of the cost of high grade metal weather strips, it does not pay to consider using the simpler and more primitive types which the handy man can install himself, except for temporary purposes or when it is impossible for some reason to obtain the more efficient metal strips.

There is one type of metal weather strip of a simple kind

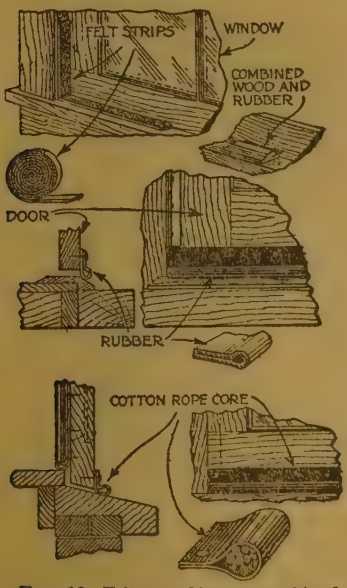


FIG. 13. Felt, rubber, combined wood-and-rubber or wood-felt, and flexible weather strips.

which the amateur can use and which is sold at some hardware stores. It consists merely of spring brass strips. The manufacturer supplies directions for its installation.

Other types of weather strips (Fig. 13), which are available everywhere and are very easy to apply, may be listed as follows:

TYPES OF WEATHER STRIPS

Felt. Sold very cheaply in rolls. Should be at least ½ in. wide when applied to inside lower sash of windows; ⅝ in. wide for outside of upper sash, and either ⅝ or 1 in. wide for the bottom of doors. Applied with copper, brass, or galvanized tacks, spaced closely. Renew every year.

Flexible Rubber. Corresponds to felt in treatment, but is more durable.

Wood and Rubber Molding. Some varieties have tubular rubber inserts, and others have solid rubber. Sold by the foot, frequently in 7- or 12-ft. lengths. Should be at least ⅝ in. wide for windows, ¾ or 1 in for the sides and top of doors, and not less than 1 or 1¼ in. for the bottom of doors. Applied with 1-in. brads spaced about 9 in. apart, except at the bottom of doors, where 1-in. round-headed brass screws are preferable to nails.

Wood and Felt. Same treatment as wood and rubber molding.

Zinc and Rubber. Often called "metallic weather strip." Should be at least ½ in. wide for windows, ⅝ in. for sides and tops of doors, and ¾ in. for door bottoms. Applied with brads spaced closely together. These strips must be well nailed.

Cotton Cord with Rubberized or Canvas Covering. A flexible strip that can be bent at the corners and carried continuously around doors and windows. Applied with 4-oz. copper or trunk tacks spaced about 1¾ in. apart. A high-class, durable strip, but as easily handled as felt.

Weather strips can be made at home by cutting old automobile

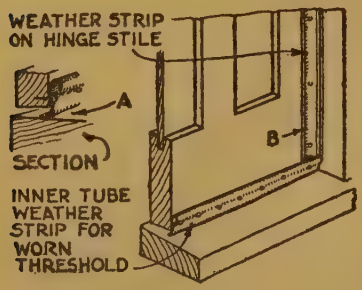


FIG. 14. How flexible weather strips may be applied to a door.

inner tubes into strips wide enough so that each can be folded over to form a cushionlike inclosure when it is tacked tight.

WEATHER-STRIPPING DOORS

Often it is difficult to put a satisfactory weather strip at the bottom of a door swinging over a worn threshold. This may be accomplished by fitting a piece of inner tube 3 in. wide at the bottom of the door, allowing the thin edges to drag over the threshold as the door is closed as at *A*, Fig. 14.

Instead of fastening the hinge joint weather strip on the door frame, it may be applied to the door as at *B*, Fig. 14, thus pressing closely against the jamb instead of being drawn into the joint as the door is closed, which often happens if the strip is fastened to the jamb.

At the bottom of doors it is preferable to place the strip on the outside edge of the door, if possible; but if the door swings in, the strip often has to be placed on the inside so as not to interfere with closing the door.

MAKING WINDOWS TIGHT

At the junction of the upper and lower sash, there may be no great need for weather strip, if the catch is adjusted to pull the sashes close together. If necessary, a single thickness of felt or rubber may be placed on the beveled inside face of the meeting rail of the upper sash.

If the inside stops of a common double-hung window sash are fitted tightly enough against the lower sash—and they can be removed easily and made tight—weather stripping of the felt, wood-and-rubber, and other inexpensive kinds is usually omitted around the lower sash. However, a strip on the outside of the bottom rail of the lower sash is sometimes desirable and is especially so with casements.

In any case, weather strips on windows should not be fitted so closely as to prevent the sash from being raised without using force.

HANGING AWNINGS

Another subject allied to those discussed in this chapter is the hanging of awnings. In many cases, when awnings are ordered from a

department store or from an awning specialist, they are hung by experts, and the handy man has nothing to do except to take them down at the end of the season.

When it is necessary to order awnings by mail, it is of prime importance to make the proper measurements. Three measurements are necessary if the awning is to be made to order. First give the outside width of the awning from one side of the frame to the other. If in any doubt as to this, give instead the distance between the outside window casings on each side and mark it as such. Next, give the height of the awning exclusive of the scalloped curtain which hangs from the frame at the bottom. Third, give the distance the awning should project from the house.

Window Shades

Window shades, like awnings, are often made to order and it is equally necessary to give exact measurements. The common way of hanging window shades is with what are called outside brackets. The window shades hang on the outside of the casings—the trimming pieces around the window. For these shades give the width and the length of the cloth, which should be at least 6 in. longer than the distance from top to bottom of the window.

In hanging shades of this type, first locate the bracket containing the hole. It should go at the right side. Slip the shade in place and mark the position for the bracket with the slot, which goes at the left, allowing a little play. Fasten the bracket at the left and try the shade.

If the shade has not sufficient "spring" and does not run up to the top of the window readily, pull it down about halfway, lift the left end of the roller out of the slotted bracket, and roll up the shade by hand; that is, by turning the roller. Now place the left end of the roller back in the slotted bracket. It will be found that the tension has been greatly increased. If the spring is too strong, simply reverse the process and unroll the shade part way by hand while the left end of the roller is free from its bracket.

The other type of window shade is hung on inside brackets which are placed at the top of the inside window stops. To order inside shades, measure the distance between the stops at the top. Make the measurements to within $\frac{1}{16}$ in. of absolute accuracy.

Shades become soiled and are ready to be discarded while the rollers are often as good as new. The rollers can be used over again by removing the shade and tacking on new shade cloth—bought by the yard—in exactly the same way as the old shades were fastened.

CHAPTER XI

REPAIRING FURNITURE

TO be able to polish and repair furniture and refinish it when necessary is most profitable. It saves repair bills, lengthens the life of the furniture, and keeps it looking at its best.

Few tools are required for making simple furniture repairs; and the materials, which vary with each job, will be mentioned when each type of work is described. It is of the utmost importance in all furniture work to take pains not to damage, bruise, or scratch finished surfaces. Nails and screws cannot be used where they will be seen, so your main reliance must be placed upon a high-grade liquid glue and a can of plastic wood cement. Mending plates and angle irons, which are sold in a great variety of sizes and shapes, can be used where they will not be conspicuous.

For filling cracks and holes in the least noticeable way, furniture men use what is known as stick shellac, which resembles sealing wax in its general appearance and is now manufactured in a wide variety of colors, both opaque and transparent, to match almost any conceivable finish. The application of stick shellac will be described later on. When it is not convenient to obtain stick shellac, sealing wax may be used.

Regluing Loose Joints

When only a joint or two is loose in a piece of furniture, it is usually possible to spring the parts far enough apart to insert glue and then bind them together or clamp them until the glue has hardened. If possible scrape off the old glue before applying new glue. Vinegar applied vigorously with an old toothbrush often will remove the old glue. If the joint is very loose, use plastic wood cement instead of glue, as glue itself will not hold a loose joint. Remove the surplus glue or cement with a cloth moistened with warm water.

A broken chair splat can be repaired as shown in Fig. 1—a good method for making many repairs without taking a piece of furniture apart.

Often a break can be repaired by simply gluing the parts, fitting them

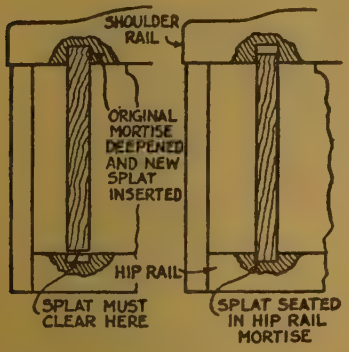

SHOULDER RAIL
ORIGINAL MORTISE DEEPENED AND NEW SPLAT INSERTED
HIP RAIL
SPLAT MUST CLEAR HERE
SPLAT SEATED IN HIP RAIL MORTISE

Fig. 1. How to insert a new splat in the back of a chair.

together carefully, laying several sheets of paper on each side of the fracture, and using hand screws, C-clamps, or other clamps to hold the parts together.

Drawers and Doors

Sticking drawers can be relieved by judiciously planing the bottom edges and, if necessary, the ends. A good coating of soapstone or talcum powder rubbed into the bottom edges of the drawers will make them slide more easily.

Tight-fitting doors can be repaired in the same way as large doors (see Chapter II).

When a door shrinks to such an extent that the friction catch or ball-and-socket catch, which is now in almost universal use, does not hold, the catch can be blocked out a trifle from the rail or, if it is an adjustable catch, it can be screwed out with a bent wire or the points of steel dividers.

How to Make Patches

When a blemish is of such an extent that it cannot be satisfactorily filled with stick shellac, it should be patched with wood. A suitable piece of wood often can be cut from some hidden parts of the furniture. Parting rails between the drawers are frequently much wider than they need to be and provide excellent surplus material for patches.

To lay out patch and "grave," a template should be made from cardboard. Lay the template in place and mark the grave with a sharp-pointed knife. To lay out the patch, use the same template, but mark with a pencil. In cutting out the grave, work to the knife line; in cutting the patch, leave the pencil mark on.

In doing graving, a chisel with an extra long bevel should be used. Bevel-edged chisels are the best, for they can be used in closer corners than square-edged ones.

Graving should never be done at right angles to the grain of the

wood. Several forms are suggested in Fig. 2.

Apply the glue to both grave and patch. Insert the patch and clamp it in place with considerable pressure. A block of wood should be placed between the clamp head and the patch to distribute the pressure evenly over the whole area.

Repairing Veneer

To replace pieces of veneer, lay them flat, glue side up, and scrape off all the old glue. Do not wet the veneer. Apply a coating of liquid glue to the board only, not to the veneer. Put the veneer in place and clamp quickly.

Blisters in veneer are caused when the glue gives way in places and air pockets form under the veneer. With the point of a very sharp knife, make an incision at or near the side of the blister where the glue still holds, and lift the edge of the blistered veneer. Pour enough vinegar in the blister to fill it up, replace the blistered veneer in its position, place the work in such a position that the vinegar will not leak out, leave for about eight hours, and remove any vinegar that has not been absorbed by the wood. Although this treatment will not actually remove the old glue, it will insure the adhesion of new glue.

Thoroughly dry (by heat) the blister and adjacent wood and make

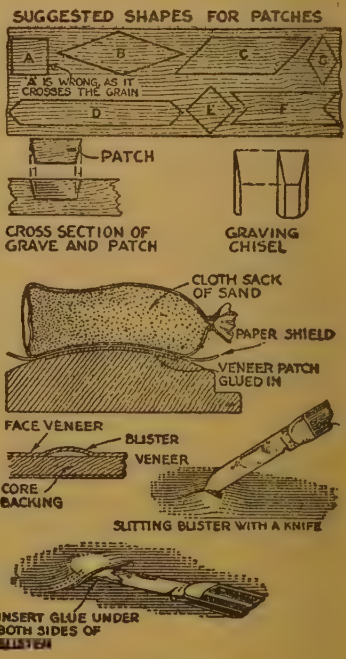


Fig. 2. Methods of patching defects and regluing blisters in veneer.

all preparations for clamping. Again lift the edge of the veneer, introduce enough glue to cover well but not too heavily the core side of the joint, and spread the glue with a thin, flat tool such as a long-bladed putty knife, spatula, steel kitchen knife, or an old corset rib, which is best of all. Replace the lifted edge of veneer, cover with several layers of paper, and set the clamps with uniform pressure. When the clamps are removed and the paper scraped off, there will be no blister;

and if the incision followed the grain exactly, it will be invisible.

When patching small defects in veneer, the template method should be used, but both the "grave" and the patch should be marked out with a sharp-pointed knife and worked exactly to the line. Cut the patch with shears as if cutting paper.

Restoring a Warped Table Top

If a valuable antique drop-leaf or gate-leg table has a badly warped top, it can be restored at the cost of what might be called a major operation in furniture repair.

Remove the top and leaves and use whatever facilities you have for getting the boards well soaked with water; if you can steam them, or get them steamed, that is best. Another method is to wet thoroughly a quantity of sawdust or shavings, or a mixture of both, and spread it 2 in. deep on the first board. Lay on the second board, cover it similarly, and do the same for the third and any others. Place convenient weights, such as bricks, on the top board and keep the sawdust or shavings wet. It will take several days at least to get the boards well soaked and probably two weeks in cold weather.

Prepare a clamp with which to draw the top and leaves straight. One can be made of rough "two-by-fours" and half-inch bolts, with a nut and two washers to each bolt. Bore the wooden pieces in pairs.

When satisfied that top and leaves are soaked sufficiently to prevent their splitting while being clamped, put them in the clamps and run all nuts down hand-tight; then start at one corner and go all the way around, giving each nut a couple of turns. Continue until the work is clamped straight. Use enough clamps so that they will not be more than 12 in. apart, center to center. Place the clamped-up work in a warm, dry place.

In drying, the boards will shrink considerably. The clamps exert most of their pressure on the edges, and when the boards shrink, the shrinkage will occur at the point where there is least pressure, or the center of the boards. To prevent this shrinkage from splitting the boards down their centers, it is necessary, in a moderately warm room, to loosen the clamps about twice a day. This allows the boards to shrink naturally. When more than one board is clamped up at a time, narrow strips of wood should be placed between the boards at each clamp; the air space allows them to dry more quickly.

When the top and leaves are thoroughly dry, take them from the clamps. They will have flat surfaces once more, but if there are any cracks or splits that cannot be glued up successfully, remove them by ripping out a piece wide enough

to include the defects. Joint (plane) the new edges; then rip and joint a piece of new material wide enough to replace the part removed, and glue up the boards into the original shape and size.

Tightening Loose Casters

Casters which have a horn projecting into a hole can be kept from falling out when the furniture is lifted by wrapping friction tape or rubber bands around the stems.

To tighten a caster of the socket type, remove it, wrap tough paper or cambric around the wood over which the socket fits, and glue well.

Chairs and other pieces of furniture without casters can be moved over the floor more easily if provided with furniture slides or glides, which are merely driven in place with a hammer. A variety of other fittings also can be obtained at well-stocked hardware stores, including rubber cushioned glides, felt, leather, and rubber tips, furniture fenders, caster cups, and chair ferrules.

Upholstering Chairs

There are a number of ways in which upholstered seats are built up and many different shapes of chairs. However, the general principles are much alike. By noting carefully just how the original materials were attached, the sizes, and similar details, while tearing down the old seat, much may be learned.

Simple upholstery often can be substituted for rush, splint, and other types of seats.

The springs are supported on strips of webbing or on metal bars. Note at *A*, Fig. 3, how the springs are tied to keep them in position. At *B* is shown a very important part in the reconstruction of seats. Two layers of the best grade of burlap are stretched over the springs

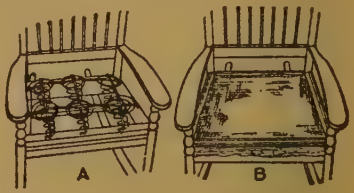


Fig. 3. The springs are covered with two layers of burlap and a rod is added to form a "roll" edge.

and tacked to the apron. A ¾-in. wooden rod is nailed to the top of the apron to form a "roll," which holds the seat filling in position and retains the shape given the new seat. This "roll" also may be made with rope or with flax tow twisted into a roll and similarly nailed.

The next step is to fill the seat with a good grade of flax tow or other suitable filling material. Do not skimp the filling.

About 3 lbs. of tow are required to fill a seat as shown in Fig. 3. Stretch burlap or any kind of cloth over the filled seat and tack it to

the apron; this gives the seat the form desired.

Now is the time to clean and refinish the chair. If this part of the job were the first to be done, it would more than likely have to be done over again after so much handling.

After the chair is refinished, the final covering is put on. A good layer of sheet cotton should be spread over the cloth, which covers the filling, and all irregularities filled out with cotton. Then the upholstering material is stretched over this and tacked underneath.

All upholstering over springs is done in a similar manner. In many cases the bar and spring method is replaced by webbing and springs, the webbing being tacked to the underside of the framework, as shown in Fig. 4. Coil springs are sewn to the crosses, then tied as before. The bar and spring method is more durable.

Springs should be used with webbing only where the seat frame is of the apron type and forms a box in which to set the springs. At the left of Fig. 4 is illustrated the flat type of seat, in which burlap should be tacked directly over the webbing, then the seat filling applied and the upholstering completed as described.

At the right of Fig 4 is shown another and more economical, only not quite so comfortable, a way of renewing worn-out seats. In this instance a board of suitable size and thickness is nailed or screwed to the underside of the seat, then filled and upholstered as just suggested. The dotted line shows the

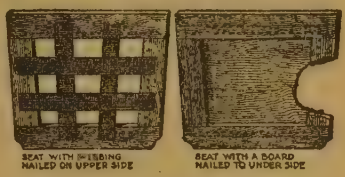


FIG. 4. Either webbing or a thin board may be applied on the underside of a flat seat to make a foundation for upholstery.

edges of the board. Figure 4 represents excellent ways of renewing cane, splint, or rush seats.

Any of the materials whose use is recommended here may be obtained from upholsterers and repair men, as, ordinarily, they carry them in stock. Pieces of upholstery materials also may be found at the same places.

RECANING A SEAT

If the chair originally had machine-woven cane, you will notice that all the edges of the cane are held in place by a strip of reed or wood embedded flush in a groove. Carefully pry up the spline. Should it break, a new length can be purchased. Clean out the groove with the chisel followed by a little hot water applied with a toothbrush.

Wash the chair thoroughly with

soap and water, to which has been added a little ammonia. Should it need refinishing, do the work now.

Spline and machine-woven cane from 10 to 18 in. wide may be purchased by the lineal foot at any upholsterer's supply house and many large hardware stores. The size known as "fine-fine" mesh is generally used for ordinary chairs. The cane should be about 2 or 3 in. larger all the way around than the opening in the chair; the spline, which is sold in three sizes, should be several inches longer than the groove. Plane or scrape the sides of the spline until it makes a fairly tight fit in the groove.

Now make three or four wooden wedges for holding the cane in place temporarily. They should be from ½ to 2 in. wide, 6 in. long, and taper from 5/16 to ½ in. Hot cabinet glue is excellent for gluing the spline, but a small can of first-class liquid glue, if placed in hot water until it is quite thin, will serve nicely.

Soak the cane in lukewarm water for two or three minutes to soften the fibers. Meanwhile apply the glue to the groove and along the sides. Place the moistened cane over the chair opening with the smooth or glossy side uppermost and let the surplus material extend equally around all four sides.

Beginning at the back, drive in one wedge, forcing the cane down into the groove. Do the same at the center of the front rail, being careful to keep the strands of the cane parallel to the front and rear rails. Repeat at the sides.

With a larger wedge, drive the cane tightly into the groove all the way around. If there are any rounded corners, do these last with a narrow wedge. Use a sharp chisel or a heavy knife and, working from the inside, cut off the surplus cane about 1/16 in. below the surface of the seat.

Put more glue in the groove and drive in the spline until it is flush with the surface of the chair. Wash off the surplus glue carefully with hot water.

In two or three days the cane will be as tight as a drumhead and entirely free from wrinkles or puckers. The application of two coats of white shellac and one of varnish to the upper and lower surfaces of the cane will help keep it taut in various temperatures.

When a caned chair which was originally hand-woven requires reseating, a 5/16 in. wide groove for the spline will have to be cut entirely around the seat frame in place of the series of holes through which the hand woven cane was originally passed. File the spur of a marking gage to a knife edge and mark the edges of the groove, which then can be cut with a chisel to a uniform depth of ¼ in.

Retouching Blemishes

A pocketknife, a sharp chisel, and a knife or other tool for melting and applying stick shellac are required for retouching furniture. As a burning iron for shellac, a cheap, medium sized screw driver is excellent. For rubbing down patched spots a small piece of felt will be needed. A good rubbing block can be made by cutting a strip from an old felt hat and wrapping it around a small wooden block.

To touch up blemishes you will need white shellac varnish thinned with denatured alcohol, or if you can obtain it from your dealer, a special retouching glaze or quick-drying varnish such as furniture polishers use.

For staining spots which have been lightened in color or cut through to the bare wood, you can mix the shellac varnish (or glaze) with dry powdered colors, which can be obtained at any well-stocked paint store. If you buy five or ten cents' worth each of raw umber, burnt sienna, bright red, and yellow ochre, you will be able to match almost any oak, walnut, mahogany, or other stained finish. For this purpose, you can also use penetrating alcohol wood dyes or, more convenient still, the penetrating spirit-soluble aniline block stains used by furniture polishers. The last are mixed with alcohol or thin shellac varnish.

To rub retouched spots smooth and relatively dull, use FF powdered pumice stone. This is applied on felt saturated in pale rubbing oil, sold by paint dealers for this purpose, or sewing machine oil. Pumice stone leaves a relatively dull surface; if a high gloss is desired, follow the pumice stone rubbing with a similar application of rottenstone powder, which is a much milder abrasive.

Natural-Finished and Stained Furniture

Deep scratches are filled with opaque colored stick shellac, light scratches with transparent colored stick shellac. To use stick shellac, heat the burning knife or screw

Fig. 5. The correct way of filling a hole with stick shellac.

driver point enough to melt the shellac without causing it to boil, and fill the scratches or cavity. Dampen a finger and quickly pack in the soft shellac. Burn on a little more, and pack again, until the

filling rounds up slightly above the surface (Fig. 5). Be careful not to let the hot iron touch the surrounding varnished surface. Then, with a knife or chisel held flat, carefully pare away the surplus shellac, and smooth with pumice stone or rottenstone and oil.

Sealing wax also can be used as a filler. This is to be had in various colors at stationery stores.

Plastic wood cement is excellent for repair work. It is best used in the natural color, which is light, and then stained after it has been dressed smooth. It can be modeled into any shape with the fingers.

Another good filler is made from glue and wood file dust. Add sufficient powdered color or stain to produce a shade to match the furniture exactly.

Touching up Enameled Furniture

Pieces which are finished in colored enamels or lacquers are retouched as just described except that only opaque stick shellac is used to fill scratches, cracks, and holes.

When merely the surface requires retouching, an enamel or lacquer can be applied with a brush or spray, provided an exactly matching color is at hand. If not, it is possible to mix a shellac enamel by using white shellac varnish colored with dry powdered colors, which can be obtained in a large variety, or with tinting colors ground in japan. If a stick of sealing wax can be found that is a perfect match, a few bits of it can be broken up and dissolved overnight in alcohol to make a quick-drying enamel.

Rub the touched-up places smooth with pumice stone or rottenstone and oil, except in the case of white enamel or lacquer, when it is better to use water in place of oil.

Scratches in both enameled and varnished furniture can be temporarily concealed with ordinary wax crayons. Polish the retouched spots lightly with a cloth to develop the luster of the wax.

Raising Bruised Spots

If a bruise is shallow, drop a little water into the depression, using the tip of a finger. Then lay a damp blotter or piece of felt over it. Place a marble or the round end of a thimble on the blotter, directly over the dent, and press it into the cavity with a moderately hot flatiron. Keep the iron in position so as to cause steam to penetrate into the wood fiber below. The cells will slowly swell and the contusion grow less and less.

When the bottom of the defect comes up to the main surface, sprinkle a few drops of oil on the damaged surface, add a small pinch of FF pumice powder, then lightly rub the fine oil-mixed grit with the

felt rubbing block until the abraded varnish has been freshened up and appears uniform with the remainder of the surface. All types of defects can be rubbed in this way. Be careful not to rub hard enough to cut through the original finish. Very little rubbing is needed, often less than ten light strokes.

Should any white show around or in the bruise, mix a little stain with shellac varnish to match the finish. A thin application of this will dry in less than an hour, whereupon another coat should be added, to give body to the surface. Rub the new film lightly with a felt-covered block until the glare of the shellac has been softened to match the original finish.

Removing White Spots

White spots such as those caused by hot dishes on a mahogany table top sometimes can be removed simply by rubbing them lightly with powdered pumice stone as previously described. The idea is to remove the discoloration but not cut right through the varnish, shellac, or lacquer.

Should the spots still show, wipe them with benzine or gasoline to remove every trace of grease and apply a thin coat of shellac—two parts of ordinary shellac and one part of denatured alcohol—to the spots only. Use a small soft brush, or, better still, a spray, and work quickly. Do not go over any part already touched. Let the shellac dry for an hour. If the spots have not disappeared, apply a second coat, let it dry, and then rub it as before.

If, after the first coat of shellac, the spots still appear too light, a second and even a third coat of shellac should be applied, but in this case the shellac should be stained. It is better to have the stain too light than too dark and depend upon applying several coats to obtain the necessary depth of color. Better than shellac for this purpose but not so easy to obtain at local stores is what is called amber glaze.

When the spots remain conspicuous, the chances are that they are too deep or the finish is too poor to make further efforts worth while. Simply sandpaper the top lightly, dust, and apply one coat of high-grade varnish, if the original finish was either shellac or varnish, or, if the original finish was lacquer, two coats of high-grade brushing lacquer, thinned to some extent with brushing lacquer thinner, so it can be brushed more easily. In case the damage has been extensive or the original finish does not appear to be of good quality, it is better to strip the original finish with varnish remover and refinish entirely.

Other methods are often recommended but may prove disastrous unless expertly applied. For ex-

ample, holding a fairly hot iron ¼ in. above a white spot will sometimes, especially with a shellac finish, cause it to disappear. Several layers of finely woven cloth may be applied over the spot and the iron pressed down on the cloth, but the cloth must be raised after each stroke of the iron or it will stick, and it will stick anyway if the finish is of a soft, cheap variety. Still another method is to pour some alcohol on the spot and let it work into the finish until the color begins to change. At that moment twice as much linseed oil is poured on the spot in such a way as to cover a slightly greater area than the alcohol. When the alcohol evaporates, the oil is cleaned off.

Hints on Polishing and Refinishing Furniture

Use only thoroughly reliable furniture polishes. Often polishes which are peddled from door to door seem miraculous in their effects at first but in the long run damage the furniture varnish. It is better to make your own polish rather than buy a cheap or inferior brand.

Lemon oil polish is generally used by piano polishers. This can be purchased prepared, or you can make it yourself by stirring ½ oz. oil of lemon into 1 qt. neutral oil, which is the type of oil used for medicinal purposes. These can be purchased from a drug store or a chemical supply house. Apply the polish, using it sparingly, with a pad of soft folded cloth, such as old linen. Rub with a circular motion. After thirty minutes rub the surface with a soft dry cloth.

Liquid furniture wax is another excellent furniture polish, provided it is of a high grade. Apply it according to the manufacturer's directions.

Furniture can be washed when necessary with a cloth wrung out in castile or other mild soap suds. Use little water and dry the furniture thoroughly. This, however, is rarely necessary. Liquid wax is in itself an excellent cleanser, and for especially soiled furniture it is possible to obtain both liquid and waxlike cleansers.

Furniture can be refinished by the various methods described for painting, filling, varnishing, lacquering, and enameling woodwork in Chapter IV. The manufacturers of finishes for furniture give explicit directions and often supplement these with excellently illustrated and most informative booklets. Do not hesitate to consult your paint dealer on all questions relating to refinishing furniture; any information he lacks, he can obtain for you.

Varnished pieces which have become dull and are slightly checked should be cleaned thoroughly, lightly sandpapered, and given a coat of high grade furniture or floor varnish or one of the new four-hour varnishes, which are brilliant

and do not collect the dust because they dry so quickly.

When the checks are extensive, it is possible to obtain an amalgamator which will soften the original finish to some extent and cause it to flow slightly in such a way as to conceal the checks in many, but not all, cases.

When a finish is in bad shape or when it is desired to change the type of finish, as from varnish to enamel, it is usually necessary to remove the old finish with paint and varnish remover. Apply the remover generously with a brush, but do no more brushing than is necessary. Let the remover alone until its action has softened the old finish. Remove the finish with a dull scraper which has been ground a little crowning or round to avoid digging in at the corners. Use a stiff bristle brush to clean carvings.

How to Use Spray Guns

A paint sprayer is of great help in refinishing furniture and is especially useful when wicker furniture has to be enameled or lacquered.

The mixing of the material is very important. Pour most of the liquid off the lacquer, enamel, or paint, and break up the pigment thoroughly. Then add the liquid to it a little at a time as you mix. Strain the material through cheesecloth tied over the top of a can.

Thick liquids like lacquer, enamel, and paint are more easily handled by the spray gun if thinned from ten to twenty-five percent with the proper thinning liquid. For lacquers, use only the special thinner provided for use with the same brand. For enamels, use turpentine; for varnishes, a very little turpentine; for shellac, alcohol. As a rule it is not necessary to thin stains at all.

Load the material cup on any siphon-feed style of gun (such as the hand pump, foot pump, and small motor types) only about two thirds full. Hold the gun as far as practical in a horizontal position and always exactly at right angles to the surface. Take particular care not to tip the gun to one side or the other and never turn it upside down.

Work the gun facing some surface of no account in order to try out the adjustment of the nozzle. Keep the gun about ten inches from the surface, but never hold it still.

Spraying, like brushing, is done by a sweeping movement. Have handy a camel's-hair or soft badger brush and use it to smooth over any runs. In the case of lacquer it may be necessary to dip the brush in lacquer thinner to dissolve the lacquer run long enough to let you smooth it out.

If you want to spray part of a surface and not all of it, mask the part not to be sprayed with wrapping paper, gummed wrapping tape, or regular masking tape.

CHAPTER XII

YOUR TOOLS AND WORKSHOP EQUIPMENT

GOOD tools delight the heart of every man. To own them gives keen satisfaction, and to put them to work is for the amateur mechanic a fascinating and profitable pastime. Certainly no household can afford to be without a chest or cabinet well filled with tools.

"What tools do I need?" is, therefore, a question of immediate and vital interest. Too often one sees a well-intentioned home owner painfully and laboriously trying to cut 4 by 4 in. rough chestnut posts for a grape arbor with a fine 18-in. crosscut saw, the teeth of which have little or no "set." The saw may be a costly and splendid tool, designed for the finest cabinetwork, but it sticks, binds, and buckles when driven by main strength through green timbers.

Conversely, another amateur mechanic, in undertaking the construction of a bookcase or kitchen cabinet will attempt to cut up the stock with a large, coarse saw, the teeth of which have been set widely so as to hew their way through rough and heavy boards.

It is possible that an expert carpenter could cut the heavy posts with a fine saw without seriously damaging it or wearing out his strength, and that he could make reasonably straight and square cuts through expensive finishing lumber with a coarse, heavy saw intended for rough work, but the amateur mechanic cannot do so. It is futile for him to try.

The question then arises as to what tools should be in the household kit. A large proportion of the jobs described in preceding chapters can be accomplished with a surprisingly small number of tools; some of the work, however, cannot be satisfactorily accomplished without a fairly complete equipment or with special tools, which it often pays to buy even if they are infrequently used.

Increased interest in the home workshop hobby in recent years has led to a marked improvement in the average household assortment of tools. It is not unusual, for example, to find a high-grade automatic spiral ratchet screw driver replacing or supplementing the ordinary screw drivers. Whereas power equipment

was once never seen in the home shop except in the form of an occasional lathe, now electric drills and complete motorized home workshop outfits are found in many homes and are taken for granted in any amateur shop that pretends to be up-to-date and complete. In homes where a few stubby paint brushes formerly comprised the painting equipment, it is not uncommon now to find high-grade brushes and also a paint spray gun.

Under these circumstances, the home owner has to use his own judgment as to what tools to buy, but he never makes a mistake in getting the best and most complete equipment he can afford. It will pay for itself many times over within a few years.

Household Tool Assortments Selected by Experts

What is the best small assortment of tools for doing repair jobs about the house and garden and for simple woodworking — a typical handy man's set that no household should be without? The editor of this book asked six shop experts this question and followed their recommendations in preparing this list:

Nail (or claw) hammer, bell face preferred
Crosscut (or hand) saw, 24 in. or 26 in., 8 points to the inch
Carpenter's chisel, socket firmer, bevel edge, 1 in.
Carpenter's chisel, square edge, ½ in.
Bit brace, 8-in. sweep, ratchet preferred
Auger bits, ⅜, ½, and ⅞ in.
Bit-stock drills for metal, ⅛ and ¼ in. (useful also for wood)
Screw drivers, 4 in. and 8 or 10 in.
Combination pliers, 6 or 8 in.
Files—saw files, 6 or 7 in.; flat or mill bastard, 8, 10, or 12 in.; auger bit file
Jack plane
Try-square, 6 or 8 in.
Steel (framing) square
Zigzag folding rule, 4 ft.
Marking gage
Pipe wrench, 10 in.
Monkey wrench, 10 in.
Miter box
Wrecking bar, small
Oilstone, artificial, combination
Nail set, 1/16 in.
Oil can
Half hatchet
Cold chisel, ⅝ in.
Putty knife

Ideal Shipshape Home Set

The six specialists next were asked: What is the ideal assortment of tools for the handy man who wishes to do all possible repairs about the house? This list naturally was arrived at by adding certain tools to the assortment already given, as follows:

All tools previously listed and—
Machinist's ball peen hammer, 1¼ lb.
Round mallet, 2½-in. face
Ripsaw, 24 or 26 in. (5, 5½, or 6 points to the inch)
Back saw, 10 in.
Hack saw frame with blades
Compass saw, 12 in.

Smooth plane
Block plane
Rabbet plane, ⅞ or 1 in.
Carpenter's chisels (socket firmer), ¼, ⅝, ¾; and 1 ¼–in. butt (short) chisel with beveled edges
Carpenter's gouge, ⅝ in.
Auger bits, ¼, ⅝, and ¾ in.
Expansive bit, ⅞ to 3 in.
Rose countersink
Screw driver bit, ⅜ in.
Bit-stock drills for metal, 5/16 in. and ⅜ in.
Hand drill with drill points
Pliers, round nose, 5 in.
Carpenter's pincers
Files—saw file, 7 in.; round bastard, 6 or 8 in.; half round bastard, 6, 8, or 10 in.; cabinet rasp, 8 or 10 in.
Winged drivers with pencil point, 6 in.
Spokeshave
Drawknife, 8 or 10 in.
Level and plumb (spirit level)
Sliding T-bevel, 8 in.
Tinner's snips
Boxwood folding rule, 2 ft.
Glass cutter
Soldering coppers, 1½ lb.
Blowtorch
Tool grinder
Dowel plate
Nail set, ⅛ in.
Scratch awl
Saw vise
Center punch
Saw set
Cabinet scraper
Cabinetmaker's clamps, 1 pair, 5 ft. long, and 1 pair 8-in. hand screws
Bench of any ordinary type with carpenter's or quick-acting woodworker's vise

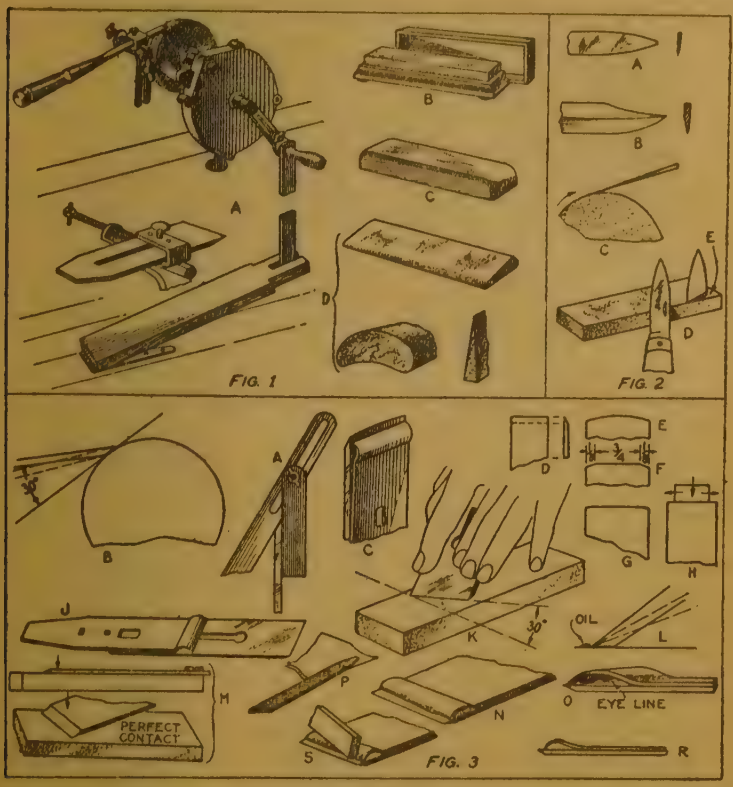
The most elaborate jobs described in Chapters I and II can be done with fewer tools than in this complete list. At the same time, the list will prove helpful in deciding what tools to add to a household collection. It does not mention many other general tools which are occasionally helpful or such special tools as those listed in Chapter IX for masonry work, in Chapter III for wall papering, and elsewhere.

How to Care for Your Tools

Home workers often seem to think that time spent in sharpening tools is largely wasted, yet it will be more than repaid in the quantity and quality of their work.

Our discussion will be centered around woodworking tools, for they are more commonly used in the home than others. A bench grinder (*A*, Fig. 1) with a 6 by 1 in. wheel will give satisfactory results in sharpening all woodworking tools and for general grinding. It can be converted to a foot-power grinder by adding a purchased or a home-made treadle, which allows both hands to grasp the tool. A combination oilstone or whetstone *B*, 1 by 2 by 6 in., coarse on one side and fine on the other, which is set in an iron or wooden box to prevent the cutting surface from becoming glazed with dust, is an excellent general purpose stone. A strop *C*, made of a piece of leather glued or tacked on wood, will make a keen edge a little keener. Slip stones similar to those shown at *D* are necessary if gouges or carving tools are to be sharpened.

From the time our primeval ancestors discovered that a broken bone or a clamshell could be worn to a cutting edge on a flat stone, the knife has been the universal tool. For general use the knife may be sharpened as at *A*, Fig. 2, but a knife for whittling should be similar



FIGS. 1, 2, 3. A grinder, a whetstone, a strop, and one or more slip stones are needed to keep tools in condition; methods of sharpening knives and planes.

to *B*. Lay the knife upon the grindstone tangent at the edge as at *C* and turn the stone toward the edge. Move the knife forward occasionally to maintain a nearly straight surface from the edge to the back. Reverse hands and grind the other side. Keep the knife moving back and forth the entire length of the edge to prevent heating. When a wire edge or minute burr turns over, the edge is finished.

Lay the knife on the whetstone as at *D*, pressing lightly upon the cutting edge so the back edge will clear the stone a very little as at *E*. Remove the wire edge by drawing the knife across a piece of wood

and give a few more strokes upon the whetstone, finishing upon the strop, if desired.

Workmen seldom think of the bevel of a cutting tool in degrees; they are guided by the eye and the "feel" of the tool. A rather thin edge is preferred in working soft wood, while a somewhat thicker edge will stand up better on hardwood and for general purposes. A thin edge is better for a paring chisel, and a thicker edge for a mortising chisel.

In deference to definition we must mention an angle; most cutting tools are ground to a 25- or 30-degree angle. Set a bevel at 30 degrees and test the bevel of a plane cutter or chisel as at *A*, Fig. 3. It is important that the bevel be true the entire width and thickness of the iron, though the periphery of the wheel will make the bevel a little hollow as at *B*.

The bench grinder may have a tool rest that can be moved from right to left, in which the tool may be clamped as shown in Fig. 1; this insures accuracy. Usually the professional mechanic prefers a stationary rest and guides the tool by holding his fingers in one position against the rest.

Plane Cutters and Chisels

When grinding a plane cutter, set the cap iron back from the cutting edge about ⅛ in. as at *C*, Fig. 3, and use it as a guide for squareness instead of testing with a try-square, which would be slower.

The edge of a chisel should be ground square across as at *D*. A jack plane or a single-iron plane for rough work should be well rounded as at *E*, while the edges of a smoothing plane iron or of a spokeshave iron should be shaped about like *F*. The edge of the jointer plane should be slightly elliptical as in *G*. In all the sketches the curves are somewhat exaggerated.

Assuming that the edge of the grinding wheel is perfectly straight and true, the edge of the cutter should be carried squarely across as at *H*, the wheel always turning toward the edge. Keep the tool moving from right to left. Grind until the cutter is in its correct relation to the edge of the cap iron, and a wire edge may be seen the entire width of the tool.

Grinding is only preparatory to whetting or oilstoning. Use lard oil or a light lubricating oil on the oilstone. Draw the cap iron back to the top end of the groove in the cutter and fasten it, as at *J*. Grasp the iron and cap in both hands as at *K*; place it across the stone at an angle of about 30 degrees and raise or lower it as at *L* until the exact bevel is attained either by feeling or by seeing the oil that is squeezed out when the cutter is properly placed. Maintain this angle, carrying the tool back and

forth the entire length of the stone. Guard against the tendency of the tool to "rock," which rounds the edge and destroys the bevel. Carrying the iron as at *K* should largely prevent this, but if it does not the worker will be justified in making circles and figure eights instead of straight motions.

When the beveled side has been whetted from fifteen to twenty-five strokes, the wire edge may be removed by a few strokes with the face of the cutter lying *flat*, in *perfect contact* with the stone as at *M*. Pressure is applied in the direction indicated by the arrows.

The cause of a clogged plane mouth usually is a badly fitting cap iron as at *N*. Hold the cutter and cap so light may be seen through the faulty joint between them as at *O*. A very bad place may be remedied by bending, but the final fitting should be done with a flat file as at *P*.

Perhaps the top side of the cap edge may have become rounded by long use as at *R*, in which case it should be bent back and filed to the same curve as a new cap iron. Be sure that the edge is kept square with the sides. Note that the file at *P* slants *down* to make a thin edge. Place the cutter and the cap iron in position as at *S* and with the corner of a chisel press firmly against the outside of the joint, which will force the steel into contact with the face of the cutter.

Gouges, Scrapers, and Auger Bits

In sharpening gouges the slip stone should be used, but unless used correctly with the hand well away from the cutting edge as at *A*, Fig. 4, an ugly cut may be received. Outside gouges may be ground on a grinding wheel by turning the hand as at *B* and whetted by the same method as at *C*.

Fig. 4. How gouges beveled on the outside are ground or whetted and the wire edge is removed.

The scraper prepares a planed surface for the sandpaper by removing the minute ridges between plane strokes; it also supplements the plane in smoothing cross-grained places. The sharpening of a scraper is a knack to be acquired by practice. Place the scraper in a vise and file the edges square across and slightly rounding lengthwise as at *A*, Fig. 5. Hold the file either lengthwise or crosswise, but move it in the direction indicated. Whet each edge to two sharp, square corners as at *B*. Apply a little oil and hold the scraper as at *C*. The edge of a burnisher or the corner of a chisel is placed in contact with the edge of the scraper as shown. Point

the burnisher or chisel *down,* keep it square with the edge, and make one light, firm stroke upward. Begin at the bottom and make a heavier stroke. Keep the angles shown exactly the same except in one respect; push the burnishing tool with the thumb in such a way as to in-

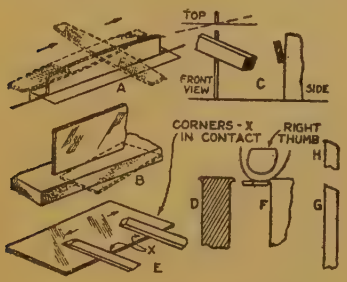


FIG. 5. A cabinet scraper is sharpened square across and the corners are then turned over a trifle.

cline it as shown by the dotted line. This will turn the corner or edge of the scraper as in the enlarged view *D.* All the edges may be sharpened.

If the scraper has been sharpened successfully, it should cut a thin, clean shaving as wide as the worker has strength or skill to produce. If the edge has been turned over too much or become dull, it may be remedied by laying the scraper flat on the bench and rubbing the edge down as at *E.* Carry the burnisher at each stroke on the corner marked *X.* Then repeat the process of turning the edge.

If the edge has been turned too far the defect often may be remedied by carrying the burnisher the length of the scraper, under the edge and against the thumb as at *F,* then giving one light stroke as at *C.*

If a scraper is well rounded on an edge or end and file-sharpened at a bevel as at *G,* it will scrape paint effectively. If whetted and the edge turned over as at *H,* it will do more satisfactory work upon floor scraping and similar rough work than the square-edge scraper.

In sharpening an auger bit, the underside of the cutter (*A,* Fig. 6)

FIG. 6. An auger bit is sharpened with a special file on top of the cutters and inside the lips.

should not be touched. The filing should be done upon the top of the cutter with a special bit file as at *B;* this file has smooth edges at one end so that lip *C* may be filed as shown at *D.* Do not file the outside of the lips; it would spoil them.

FILING SAWS

The average home worker had better sidestep saw filing unless he can practice upon a saw of no great value. We will assume, however, that our readers wish to go the

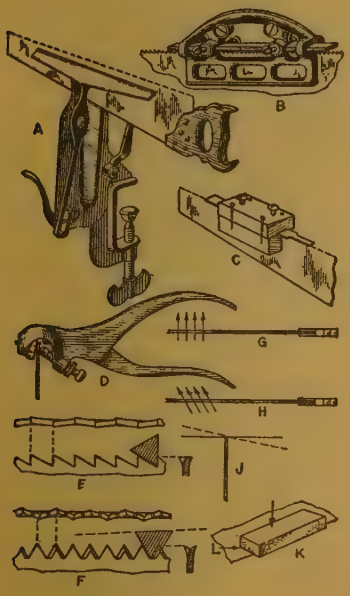


FIG. 7. How the teeth of a rip saw (*E*) and a crosscut saw (*F*) are sharpened.

whole distance. Place the saw in a saw filing vise as at *A*, Fig. 7. With a flat file held in the fingers or in a jointing device of some kind, take one or two strokes lengthwise to "joint" the saw, or to make the teeth of uniform length, as at *B*. A jointer may be made of wood as at *C*. With a saw set *D* bend out alternate teeth for one third of their length from the point; then do the same from the other side. At this stage a ripsaw should appear as at *E* and a crosscut saw as at *F*.

In filing a ripsaw begin at the point and file every tooth square across, carrying the file at right angles as at *G*. Hold the file so the side which is filing the front of the tooth behind it stands vertical as at *E*. The amateur may find it easier to file a ripsaw from each side, filing the teeth that are set away.

In filing a crosscut or cutting-off saw the file should be carried at an angle pointing toward the end of the saw of about 60 degrees with the saw blade as at *H* for a general purpose saw, rather less if for soft wood only. Many mechanics, however, point the file toward the handle.

The file should be carried as at *F* to give each tooth "hook," which is a large factor of the "sweetness" of the cut.

Some prefer to carry the file level as at *J*, although many lower the hand a little as shown by the dotted line. This applies to cutting-off saws and ripsaws if filed from both sides, but in every case the teeth should be of uniform length. This may be attained by watching the glint of light on the end of the teeth where they were touched by the file when jointing them. Remove about half of the glint from each tooth from the first side and the rest from the other side.

Lay the saw upon a perfectly flat surface and carry a flat file or whetstone from handle to point over

the teeth to remove the burr. Keep the pressure as at *K* so the stone will bear a little harder at the edge marked *L*.

Protecting Tools from Rust

Tools can be kept from becoming rusty under all ordinary circumstances if they are wiped occasionally with a cloth that has been

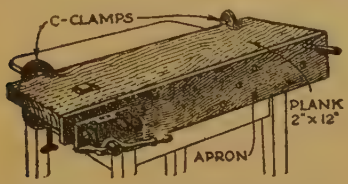


Fig. 8. One ferm of bench top with vise and adjustable stop.

saturated with a good grade of light lubricating oil. This treatment will keep both the steel and the wooden parts looking almost like new.

If the steel should get damp or spotted with rain, remove the marks with a piece of very fine sandpaper or fine pumice stone powder and oil. When tools are to be put away for some time, it is advisable to mix a little vaseline with the oil to give it a greater body.

When tools are subjected to considerable dampness they can be protected by the following mixture: Melt 1 part rosin in 6 parts lard and add benzine in about the proportion of 1 pt. to ½ lb. lard. Mercurial ointment also is used to rub over tools.

If damp proof drawers, closets or cabinets are not available a carpenter's "shoulder box" is a good substitute. By getting into the habit of slipping the tools into their individual racks or places every time one gets through using them, and if the oil rubs are not omitted, the tools can be kept in good shape even in a damp place. Boxes arranged to receive complete working sets of tools are now made at reasonable prices. Bits, chisels, and

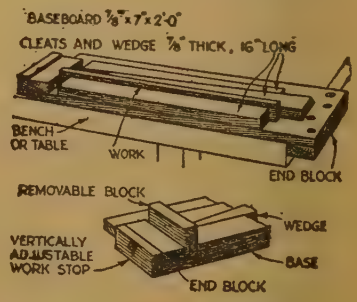


Fig. 9. A combination vise, "shoot" board, and regular bench block.

gouges are often kept in cloth rolls with pockets for each tool. These usually come with complete sets of tools, but they easily can be made at home.

Hints on Making Benches

No one who undertakes household repairs will long be content to do without a bench of some kind. While it is impossible in this chapter to tell in detail how to make

the various common types of work benches, a few designs can be illustrated.

The simplest arrangement is a board that can be used on the kitchen table as shown in Fig. 8. It is possible to do some small, light work on an even smaller board such as the one shown in Fig. 9.

A heavily built kitchen table can be converted into a bench as shown in Fig. 10. A cabinet bench is shown in Fig. 11 and an improved type of carpenter's bench in Fig. 12.

A workbench must be strong and rigid. The errors of the inexperienced

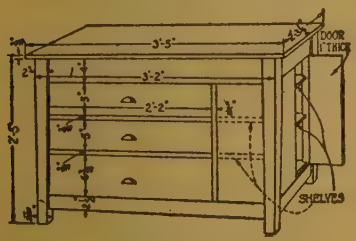


FIG. 10. Heavy kitchen table converted into a cabinet bench.

home worker in constructing a temporary bench and the later disappointments from inaccurate and unsatisfactory work are too common to be needlessly repeated. After all, it takes nearly as much material and time to make a poor bench as a good one; the difference is chiefly in the design and the care with which the work is done. No really expert mechanical ability is required. Accuracy in taking and working to measurements is necessary, for the bench must be square and level, but this requires care rather than skill.

The wood to be used depends somewhat upon what is easily obtainable. It is advisable to use hardwood for the top piece; but, if the bench is not to have excessive use, hard pine or even Douglas fir will last a long time. All parts except the top can well be of soft wood; indeed, it is perhaps better for the beginner not to attempt to make the framework of hardwood.

When the lumber has been delivered, the first step is to cut the pieces roughly to the lengths in which they will be used. Remember that haste makes waste. It is a wise plan to lay out and label each of the pieces before doing any of the cutting.

If you can visualize the work so clearly that you know just what each piece of lumber is for, it is not necessary to cut out all the pieces at once; in fact, a workman of experience probably pays little attention to these suggestions and will prepare only the material for the frame. However, it pays a beginner to lay out the pieces in advance as a safeguard against discovering during the course of the work that some boards have been ruined for their purpose by unwise cutting.

In the method of procedure, too, the expert and the amateur do not follow the same steps. One good method to use in making the bench from this point is as follows:

Check up on the legs for squareness. If two adjacent sides can be found that are straight and reasonably square to each other, it is not necessary to do any planing, except possibly to clean the surfaces. If they are not square, it is better to plane them down in order to avoid future trouble.

Mark the two face sides of each leg thus selected and plane the other sides until all are the same size, working from the face corner. Now cut the legs to the right lengths. The bench is usually 33 in. high, but a rather short person may find 32 in. better.

True up the rails and perform any special work required by the design of the bench you are building. Lay out the mortises and the tenons and cut them carefully. Now assemble the bench, using clamps wherever necessary to hold glued parts together until the glue is dry.

For the heavy-duty bench (Fig. 12) hard (yellow) pine can be used throughout with the exception of the leg at the vise and the vise jaw, which should be made of maple or a similar hardwood. The top also will be better if of hardwood, but the construction will be a little more difficult.

Hardware and Supplies

Countless devices are available to make repair work easier. Some of these have been mentioned in preceding chapters.

Do not be backward about asking for assistance when you are in doubt as to what to purchase for a job.

For example, suppose you wished to attach a heavy hinge or other fittings at the corner of some soft woodwork which you felt certain would not hold the screw or screws

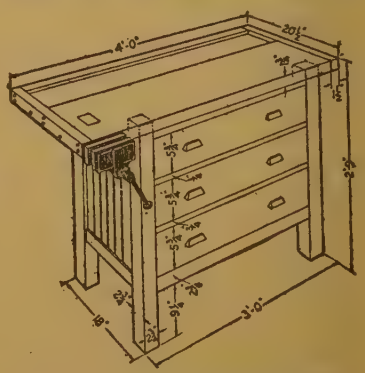


Fig. 11. A bench especially suitable for the home workshop.

for any length of time. To meet this very problem you can usually obtain a "screw-tight" fitting; it consists of a pointed brass plate with a hole tapped in it to receive a brass screw. The plate is driven into the edge of the wood in such a way that the screw can be passed through from the front to engage the thread in the plate. Again, if you wish to fasten down a rug or a strip of carpet on a highly polished floor, you can buy "rug-tight" fasteners.

To give anything like a complete list of the products available for the amateur mechanic would far exceed the limits of this chapter, but the items mentioned are sufficient

to indicate the trouble you can save yourself by finding out what can be obtained.

Gardening Tools

A home worker who has mastered the art of keeping his bench tools in good order will have no difficulty in looking after the gardening tools and seeing that they are sharp, clean, and in good order.

The lawn mower requires the most care. It should be kept well lubricated and at least once a season should be cleaned thoroughly with kerosene. Any looseness in the bearings can be remedied by turning the set screws provided for that purpose. The stationary blade also can be adjusted so that it will just touch the cutters which revolve.

If a lawn mower is very dull, it should be sent to a specialist to be sharpened. If it is only slightly dull, it can be sharpened by removing the wheels, taking out the pinions (small gears), and putting the pinion from the right-hand wheel in the left-hand wheel and vice versa. When reassembled, the lawn mower will be found to run backward instead of forward.

Mix fine silicon carbide powder with machine oil (or use valve grinding compound) and spread the paste over the stationary blade. Then push the mower upside down along a concrete sidewalk or floor. The revolving blade will be sharpened against the stationary blade, which should be tightened from

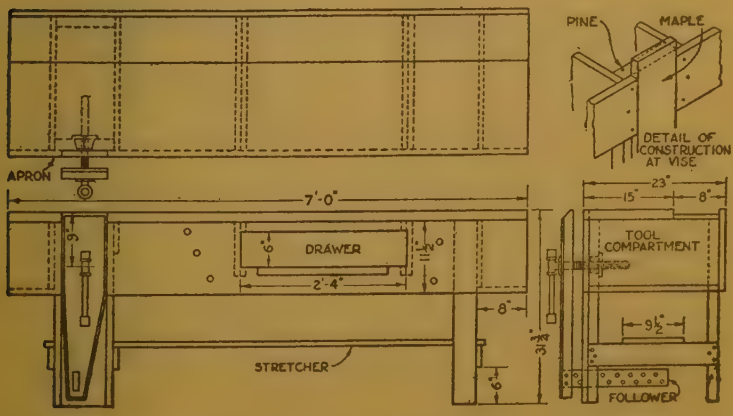


Fig. 12. Top, front, and end views of a heavy-duty bench, and a detail of the stationary vise jaw.

time to time as necessary. A file can be used for beveling the extreme end of each blade where the points are likely to be too high; do this before starting to grind.

Clean off all the grinding compound, replace the pinions in their original positions, reassemble, and oil the bearings thoroughly.

Corrugated Fasteners, Nails, and Screws

Few home workers realize the advantages of corrugated fasteners (Fig. 13) for making strong joints. The sizes range in length between ¼ and 1 in. by eighths and in width from two to seven corrugations. They come in two styles of edges, plain and saw tooth. Both types are to be had with either straight or divergent corrugations. The straight are preferable if the joint is well made, but if not, the tapered fasteners will draw the joint together. The fasteners illustrated have divergent corrugations.

Confidence is needed in driving nails. Grasp the handle at or near the end. Start the nail with a good blow, not a timid one, and make the hammer swings short and snappy. They should be jolts; far-reaching swings are not necessary. See that the face of your hammer is clean. Rub it on a board, on the earth, or, if in very bad shape, on fine sandpaper.

If the hammer has no hole in the end of the handle for soap or wax, bore a ¼-in. hole about ½ in. deep and keep it filled with soap. When using finishing nails in hard wood, dip the point of each nail in soap. It will surprise you how much easier the nail can be driven.

Before screws are driven in any but very soft woods, holes should be bored as deep as the shank of the screws. In hard woods, these first holes should be the exact size of the screws. Then a size smaller bit or drill should be used to the full depth of the screw or nearly so.

Do not try to force in a screw by main strength. You may have the screw break off and give much

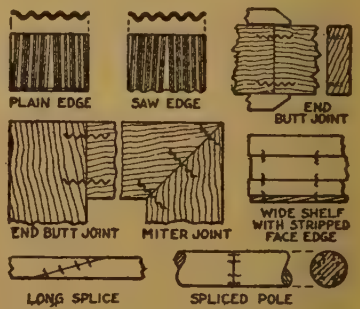


Fig. 13. Methods of making joints with corrugated fasteners, which are hammered into the wood.

trouble. Take it out and bore a larger or longer hole. Apply soap on the threads.

Many old screw drivers give trouble because they constantly slip. This is because the point has been ground or filed at too sharp an angle. A screw driver should have a

very gradual taper toward the point, and the closer it fits in the slot of the screw, the easier is the work.

Use a countersink bit for hard woods and put it in just the right depth for the size of the head of the screw used, and no more.

Using Sandpaper

Good sandpaper is often thrown away before its usefulness is over. Dust and gum, which fill in between the grits, can be removed by snapping the paper forcefully against the work or the top of the bench. Turning the paper around on the block also prolongs its life because new edges of the gritty abrasive are presented to the work in each position.

Ordinarily, for flat work, the paper is held around a block of wood, leather, or rubber. Moldings and carved or odd-shaped work can be rubbed by wrapping the sandpaper around a short length of molding, a shaped piece of wood, or a folded wad of corrugated paper.

To divide sandpaper into convenient sizes, bend it over a sharp edge several times and then tear it apart.

Caring for an Oilstone

To keep your stone in condition, use a good grade of mineral oil, wipe the stone off when you are through with it, and keep it in its case or at least in a place where it will be free from dirt.

After an oilstone has been used for some length of time, it is apt to become hollowed out in the middle. Check your own stone by holding it before a light and laying the edge of a square along it.

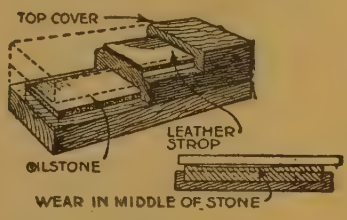


Fig. 14. An oilstone with a strop, and method of testing flatness.

The surface of a worn oilstone may be dressed to a plane surface on the side of a grindstone, or it may be rubbed down with an emery brick. Another method is to tack a sheet of emery cloth to the bench-top or other flat surface and rub the stone back and forth upon the cloth, stopping now and then to clean the dust from the cloth and to try the stone with a straightedge.

A piece of leather glued to the top of the oilstone case makes an excellent strop for putting the final edge on a tool. It is desirable to make a second cover, as shown in Fig. 14, to fit over the leather and protect it from the dust, if the oilstone is not kept in a dustproof drawer or cabinet.

Cements for Special Repair Work

White lead-in-oil paste is an excellent cement for broken china. First rub the raw edges of the dish a very little with emery cloth to make room for the thin layer of white lead, so that the dish when completed will not be distorted in shape. Then apply the white lead and hold the pieces firmly in place by dropping melted sealing wax at intervals on the cemented joint.

The dish should then be set away and left for eighteen months or more to give the white lead time to harden thoroughly. At the end of that time the sealing wax can be picked off and the seams carefully scraped to remove any excess of white lead. A dish so repaired will stand washing and reasonably careful handling.

Professional china menders use rivets of silver or copper wire in addition to a cementing process.

The home worker can supply pieces missing from a broken china dish or vase with fair success if they are not too large. Plaster of Paris is worked up with a good quality of liquid glue or other liquid cement until the mass is as stiff as putty. Work some of the material into the space to be filled, mold into place, and rub with a wet finger tip until smooth. The material used acts as its own cement.

When the plaster of Paris is perfectly dry, it may be tinted with artist's oil paints.

Almost anything made of celluloid can be repaired, patched, built up, and otherwise worked with the aid of celluloid cement or ordinary film cement such as is used in splicing motion-picture films. Weak joints can be reinforced with a puttylike mixture of film cement and scrap celluloid—bits of old camera films from which the emulsion has been washed with hot water.

Litharge and glycerin form a very hard, quick-drying cement, often used for pipe joints, attaching ferrules, and the like.

Uniting broken pieces of marble, plaster-of-Paris figures, alabaster, and objects made from composition ivory is not difficult provided the broken pieces are not too heavy and are not subjected to much wear. To make a cement for this purpose, mix four tablespoons of plaster of Paris with one tablespoon of powdered gum arabic. When it is to be used, add a little cold water until a thick paste results on mixing. Apply this paste within five minutes of preparing, as it sets and hardens rapidly.

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